GWOU ADMINISTRATIVE RECORD
SECTION TITLE:
GW-400-401-1.01

Department of Energy
Oak Ridge Operations
Weldon Spring Site
Remedial Action Project Office
7295 Highway 94 South
St. Charles, Missouri 63304

84970

September 22, 1999

Mr. Dan Wall
Project Manager
U.S. EPA
Region VII
901 North 5th Street
Kansas City, Kansas 66101

Dear Mr. Wall:

RECORD OF DECISION FOR REMEDIAL ACTION FOR THE GROUNDWATER OPERABLE UNIT AT THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE (September, 1999) – Official Review Copy

Copies of the subject document are provided in accordance with the Department of Energy/U.S. Environmental Protection Agency (Region VII) Federal Facility Agreement. This document has undergone internal reviews and is inclusive of all major comments; therefore, DOE considers this final exclusive of any changes from the EPA and MDNR reviews. As discussed in our meeting in Jefferson City on Friday, September 10, we would like to pursue an expedited review of this document. We have addressed all comments and concerns provided in writing and at the public meeting. We have also addressed the technical concerns from the September 10 meeting and understand that there remain some discussions on the wording of the stewardship obligations for this ROD.

By copy of this letter with the enclosure, we also are sending this document to the MDNR for their review.

We anticipate hearing from you on or before September 27 if there are any substantive changes that must be made prior to EPA's ROD signature.

Please contact Karen Reed at (636)926-7008 if any have any questions or comments.

Sincerely,

Stephen H. McCracken
Project Manager
Weldon Spring Site
Remedial Action Project

Enclosure:
As stated

cc w/enclosure:
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DOE/OR/21548-798

Record of Decision for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site

September 1999

U.S. Department of Energy
Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

DOE/OR/21548-798

Record of Decision for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site

September 1999

prepared by

Environmental Assessment Division, Argonne National Laboratory

prepared for

U.S. Department of Energy, Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri, under Contract W-31-109-Eng-38

DECLARATION STATEMENT

Site Name and Location

Weldon Spring Chemical Plant
St. Charles County, Missouri

Statement of Basis and Purpose

This Record of Decision (ROD) presents the selected remedial action for the Groundwater Operable Unit (GWOU) of the U.S. Department of Energy's Weldon Spring Site in St. Charles County, Missouri. This action was selected following requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. National Environmental Policy Act (NEPA) issues related to the chemical plant area have also been addressed and have been integrated into the CERCLA decision-making process for the GWOU.

This decision is based on the *Administrative Record* for the GWOU. Major documents include the (1) Remedial Investigation/Feasibility Study Work Plan, (2) Remedial Investigation and Baseline Risk Assessment Reports, (3) Feasibility Study Report and Supplemental Feasibility Study, and (4) Proposed Plan. Public comments received during the review period for the Proposed Plan were considered and have been incorporated into this decision.

The State of Missouri concurs with the selected remedy.

Assessment of the Site

The response action selected by this ROD addresses actual or threatened releases of hazardous substances from this site that were not addressed under previous response actions.

Description of the Selected Remedy

The GWOU is the second of two operable units established for the chemical plant area of the Weldon Spring site. The first operable unit, the Chemical Plant Operable Unit, addressed the excavation of soil, dismantlement of buildings, and removal of other source materials located at the chemical plant proper. The selected remedy for the GWOU provides for active in-place treatment of the trichloroethylene (TCE) in groundwater at the chemical plant area. This would be combined with long-term monitoring of the groundwater and springs prescribed by the monitored natural attenuation alternative. The data obtained would be used to verify the beneficial effects of the source removals performed and to confirm that the contaminated zones are not expanding and that contaminant levels are decreasing with time.

The major components of the selected remedy are:

- In-place treatment via chemical oxidation of TCE-contaminated groundwater,
- Monitoring for the long term to confirm that the natural processes currently occurring continue,
- Monitoring for the long term to confirm that the contaminated zones are not expanding to new areas and that groundwater contaminant levels are diminishing with time, and
- Implementation of institutional controls to prevent the use of groundwater for drinking.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with applicable or relevant and appropriate requirements, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. This remedy satisfies the statutory preference for treatment as a principal element of the remedy in that treatment is being conducted to eliminate the highest potential risk contributor from the groundwater.

The following federal and State of Missouri requirements are waived under this ROD:

- Title 40, Part 141.62, of the *Code of Federal Regulations* (40 CFR Part 141.62) and Title 10, Part 60-4.100, of the *Code of State Regulations* (10 CSR Part 60-4.100) - federal and state maximum contaminant unit (maximum contaminant level [MCL]) of 10 mg/L for nitrate (N). CERCLA provision for waiver: Section 121 (d)(4).
- 10 CSR Parts 20-7.015 and 20-7.031(5) and Table A - state limit of 0.11 μg/L for 2,4-dinitrotoluene. CERCLA provision for waiver: Section 121 (d)(4).
- 40 CFR Part 192 - federal groundwater concentration limit for uranium of 30 pCi/L for uranium-234 and uranium-238 combined. CERCLA provision for waiver: Section 121 (d)(4).

Because groundwater contamination will remain at the chemical plant area at levels that exceed those for unlimited groundwater use and unrestricted exposure, a review will be conducted within five years after commencement of the action to evaluate conditions of the groundwater at the chemical plant area and to ensure that the remedy continues to provide adequate protection of human health and the environment. The five-year reviews will be developed in consultation with the U.S. Environmental Protection Agency and the Missouri Department of Natural Resources and will be made available to the public.

Regional Administrator U.S. Environmental Protection Agency Region VII	Date
Assistant Manager for Environmental Management Oak Ridge Operations Office U.S. Department of Energy	Date

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NOTATION

The following is a list of the acronyms, initialisms, and abbreviations (including units of measure) used in this document. Acronyms and abbreviations used only in tables and figures are defined in the respective tables and figure captions.

ACRONYMS, INITIALISMS, AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CSR	*Code of State Regulations*
DA	U.S. Department of the Army
DNB	dinitrobenzene
1,3-DNB	1,3-dinitrobenzene
DNT	dinitrotoluene
2,4-DNT	2,4-dinitrotoluene
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FS	feasibility study
GAC	granular activated carbon
GWOU	groundwater operable unit
MCL	maximum contaminant level
MDNR	Missouri Department of Natural Resources
MDOH	Missouri Department of Health
MNA	monitored natural attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
PP	proposed plan
RD/RA	remedial design/remedial action
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
TBC	to-be-considered (requirement)
TCE	trichloroethylene
TI	technical impracticability
TNB	trinitrobenzene
1,3,5-TNB	1,3,5-trinitrobenzene
WSSRAP	Weldon Spring Site Remedial Action Project
WSTA	Weldon Spring Training Area

Units of Measure

ft	foot (feet)	µg	microgram(s)
gpm	gallon(s) per minute	mg	milligram(s)
ha	hectare(s)	mi	mile(s)
km	kilometer(s)	min	minute(s)
L	liter(s)	mL	milliliter(s)
m	meter(s)	pCi	picocurie(s)

RECORD OF DECISION FOR REMEDIAL ACTION FOR THE GROUNDWATER OPERABLE UNIT AT THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE

1 SITE HISTORY

The U.S. Department of Energy (DOE) Weldon Spring Site consists of two noncontiguous areas: the chemical plant area and the quarry area. Both areas are located in St. Charles County, Missouri, about 48 km (30 mi) west of St. Louis (Figure 1). The U.S. Environmental Protection Agency (EPA) listed the quarry on the National Priorities List (NPL) in 1987, and the chemical plant area was added to the list in 1989.

The 88-ha (217-acre) chemical plant area lies within the boundaries of the ordnance works area (Figure 2). The chemical plant was used for trinitrotoluene (TNT) and dinitrotoluene (DNT) production from 1941 to 1945 and later as a uranium-processing facility from 1957 to 1966. The sources of contamination at the chemical plant area are those shown in the original layout of the chemical plant area (Figure 3). These consisted of approximately 40 buildings, four waste retention ponds (referred to as raffinate pits), two ponds (Ash Pond and Frog Pond), and two former dumps (north and south). Remediation of the buildings, Frog Pond, and the north dump has been completed. The remaining source areas are in the process of being remediated or are scheduled for cleanup within the next year. The chemical plant is currently fenced to restrict public access. Burgermeister Spring, which is hydrologically connected to the chemical plant area groundwater, is in the August A. Busch Memorial Conservation Area.

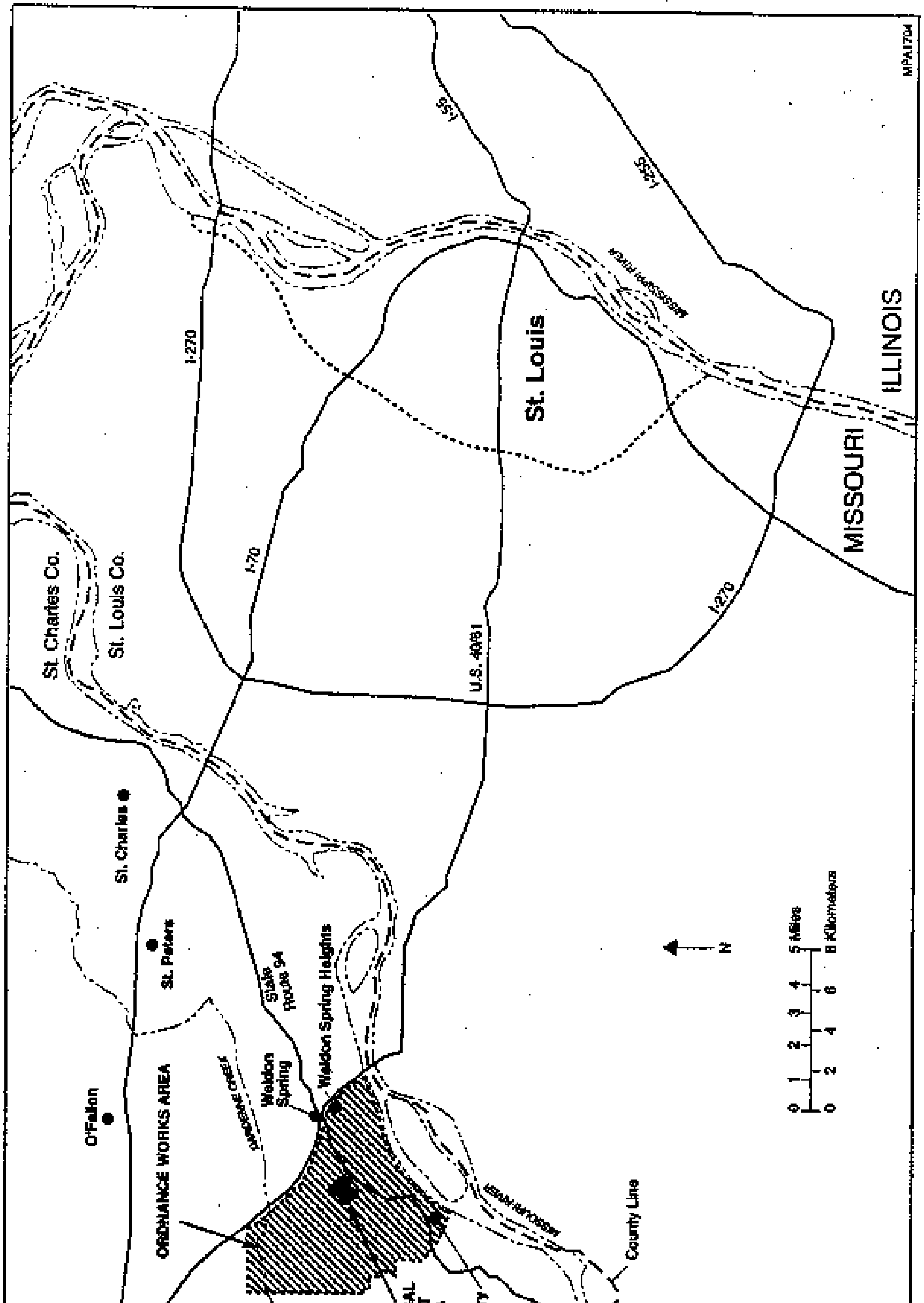


FIGURE 1 Location of the Weldon Spring Site

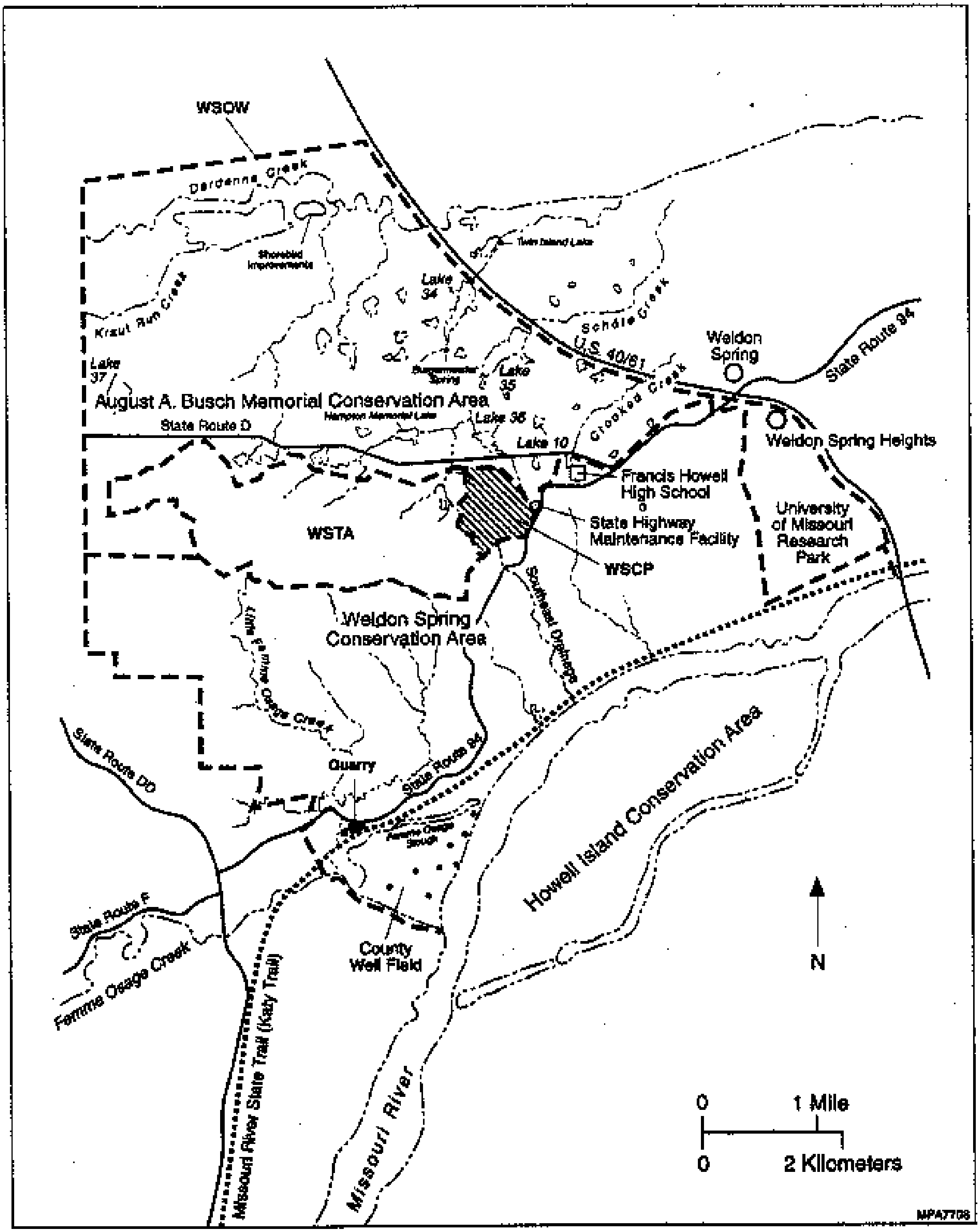


FIGURE 2 Map of the Chemical Plant Area and Immediate Vicinity

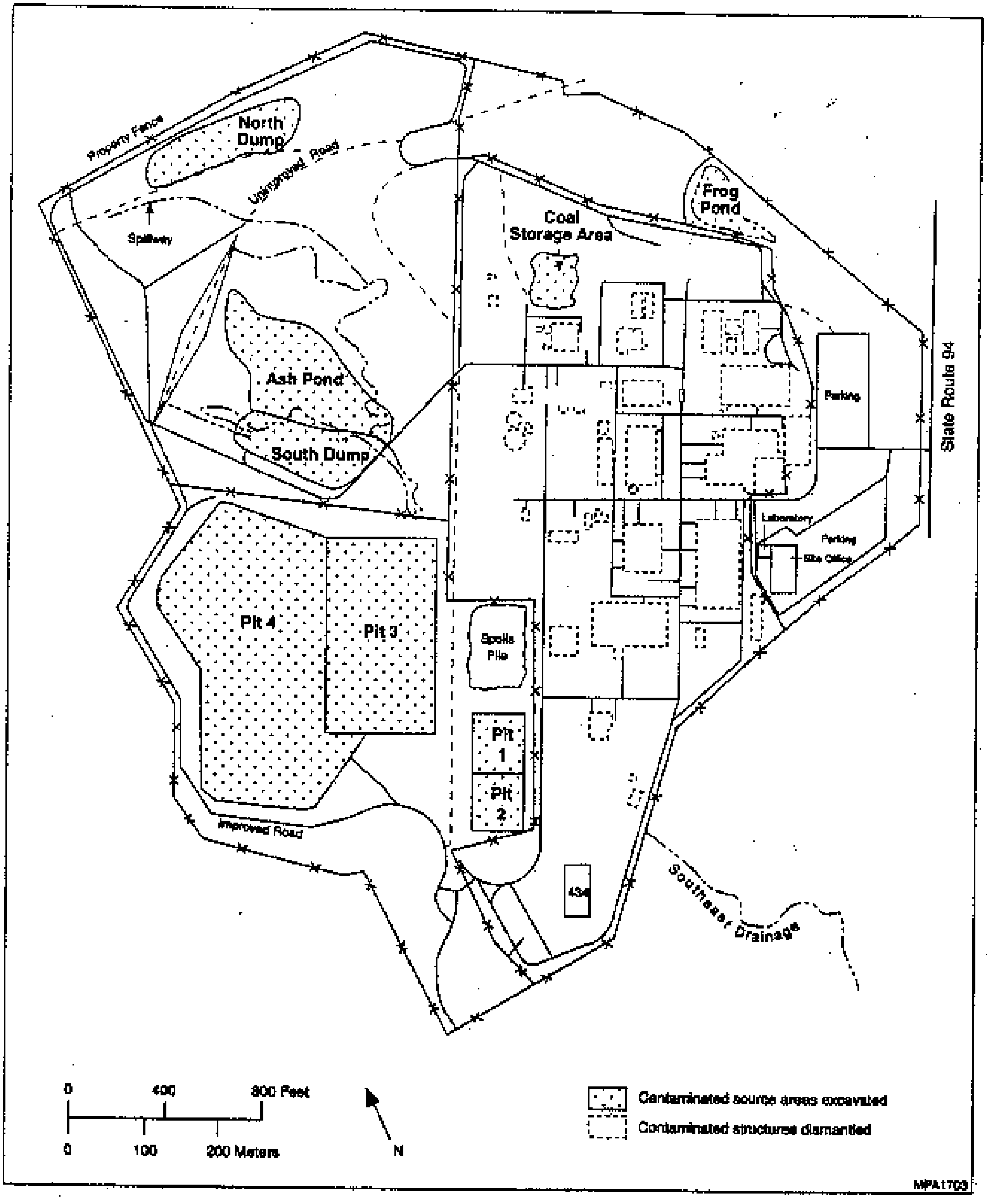


FIGURE 3 Original Layout of the Chemical Plant Area

2 SCOPE AND ROLE OF REMEDIAL ACTION

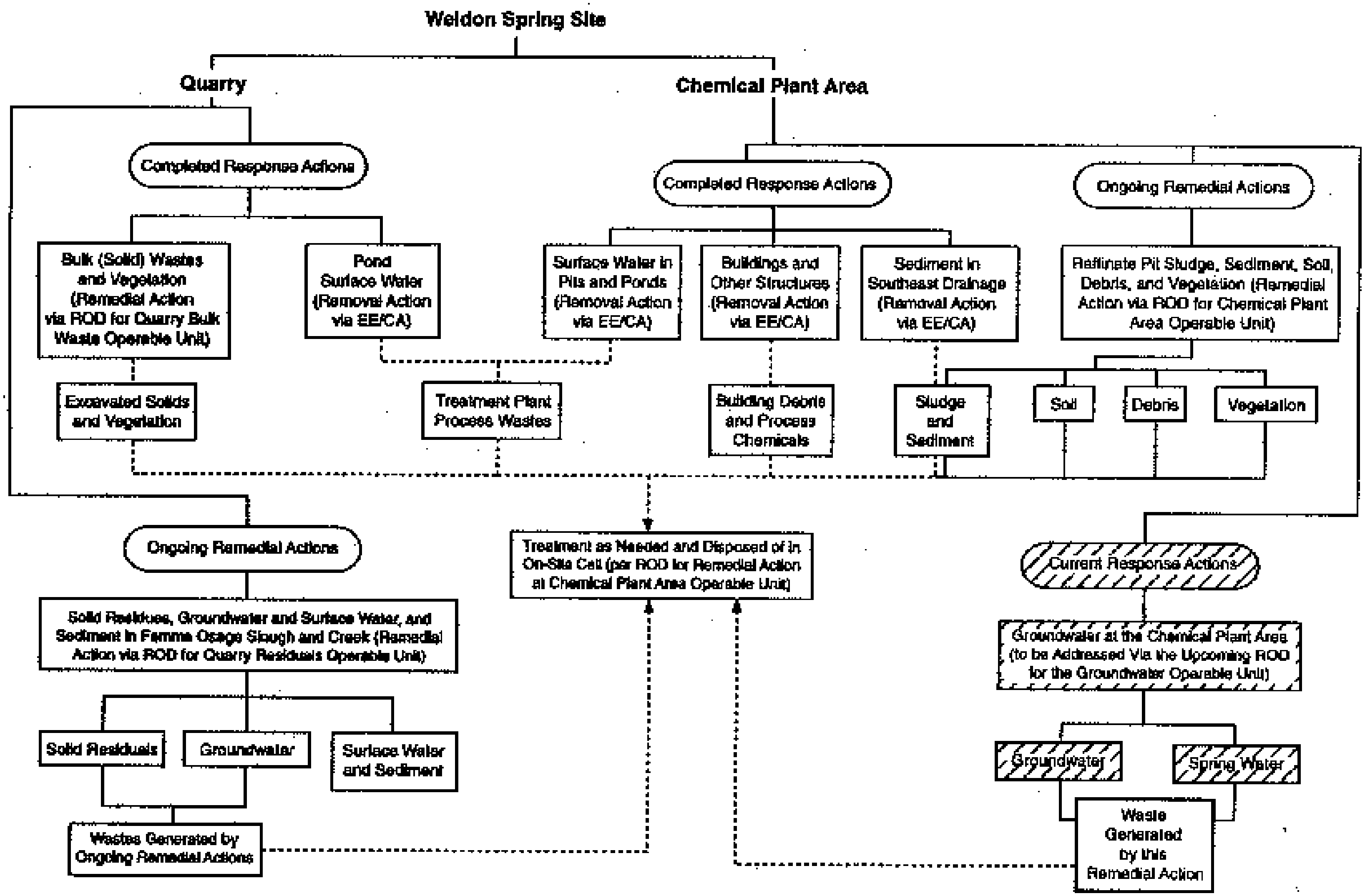
The selected remedial action for the groundwater operable unit (GWOU) constitutes the remaining component of the phased cleanup process for the Weldon Spring Site Remedial Action Project (WSSRAP) (Figure 4). This action addresses contaminated groundwater and springs at the chemical plant area. Consistent with this action (and previous actions of the WSSRAP where residual conditions limit land use), DOE will prepare a plan that defines stewardship responsibilities and is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. This plan will address requirements for long-term surveillance, monitoring, and maintenance; land use assurance; roles and responsibilities; and public participation. Like all remedial activities that have been conducted at the Weldon Spring site, the EPA, the state, and other stakeholders (e.g., organizations representing the interest of the public) will have the opportunity to review and provide input to site stewardship planning activities.

The remedial action stipulated in the Record of Decision (ROD) for the chemical plant (DOE 1993) provided for the removal of the sources of contamination to groundwater. Under the chemical plant remedial action, contaminated soil has been excavated, buildings and structures have been dismantled, and raffinate pits surface water and sludge have been removed or dredged and treated. The placement of the resulting waste at the on-site disposal cell is currently being completed.

Decisions for the quarry are recorded in the RODs for the bulk waste and quarry residuals operable units (DOE 1990b; 1998a). The remedial action to remove and treat contaminated pond water and remove bulk waste has been completed, and the generated waste has been placed at the on-site disposal cell. The remedial action for the quarry residuals operable unit is currently in the remedial design stages; implementation is expected to begin in the fall of 1999.

The purpose of this selected remedial action is to provide an appropriate response that would verify that groundwater contaminant levels are decreasing with time as a result of the source removals at the chemical plant and as a result of the continued effects of the natural processes of dilution and dispersion. The selected remedial action also provides for an active response to reduce trichloroethylene (TCE) levels in groundwater at the chemical plant area. (TCE has been found primarily in the areas designated as Zones 1 and 2 in the evaluations presented in the Feasibility Study [FS] [DOE and DA 1998] and Supplemental FS [DOE 1999b]).

Consistent with DOE's policy of integrating National Environmental Policy Act (NEPA) values into evaluations performed under CERCLA, the remedial investigation (RI) for the chemical plant area GWOU included an assessment addressing ecological impacts at the surface springs and hydrogeologic studies for water quality and aquifer characteristics. The results of the ecological investigations indicate that adverse effects to the biota from site-related contaminants are not evident. The FS (DOE and DA 1998) evaluated environmental impacts associated with the



Note: The boxes represent contaminated media addressed by the project's cleanup actions for the chemical plant area and the quarry; they are connected by solid lines to the appropriate phase of site cleanup. Dashed lines identify waste generated as a result of the completed response actions (e.g., plant treatment process wastes from treatment of quarry pond surface water) that is currently stored at the chemical plant area awaiting treatment and disposal in the on-site cell. Boxes with cross-hatching constitute contaminated media that are being addressed as part of the GWOU and this ROD. The GWOU is the final of four operable units for the Weldon Spring site.

FIGURE 4 Remediation Components for the Weldon Spring Site

alternatives considered for this selected remedy. Minimal short-term impacts on recreational use of wildlife areas would occur as a result of noise, exhaust fumes, and dust associated primarily with the construction of new monitoring or application wells. Potential impacts to the environment would be avoided by the implementation of mitigative measures. Minimal worker risks would result from the construction of new monitoring or application wells.

3 COMMUNITY PARTICIPATION

A RI/FS process was conducted for the GWOU of the Weldon Spring site in accordance with the requirements of CERCLA, as amended, to document the proposed management of the groundwater and springs at the chemical plant area. Documents developed during the RI/FS process included the *Remedial Investigation* (DOE and DA 1997b), *Baseline Risk Assessment* (BRA) (DOE and DA 1997a), *Feasibility Study* (DOE and DA 1998), *Supplemental Feasibility Study* (DOE 1999b), and *Proposed Plan* (PP) (DOE 1999a). Together, the RI, BRA, FS, and PP constitute the required primary documents, consistent with the provisions of the *First Amended Federal Facility Agreement* entered into between DOE and the EPA. In accordance with Section 117 of CERCLA, copies of these final documents were released to the public on August 3, 1999.

The RI, BRA, FS, and PP, along with other documents in the *Administrative Record*, have been made available for public review at the Weldon Spring site. Copies also have been made available to the public in information repositories at Francis Howell High School and at four branches of the St. Charles City/County Library: Kathryn M. Linneman, Spencer Creek, Middendorf-Kradell, and Kisker Road. A notice of availability of these documents was published in the *St. Charles Journal* on August 4 and 8, 1999.

A 30-day public comment period for the PP was held from August 3 through September 1. The PP identified the proposed action of active remediation of the TCE and long-term monitoring for natural attenuation of all contaminants. A public hearing was held on August 25, 1999, at the Administration Building of the WSSRAP as a part of the public participation process. This public hearing was advertised in the *St. Charles Journal* on August 22, 1999, and the *St. Charles Post* on August 23, 1999. At this meeting, representatives from DOE and EPA Region VII received comments from the public about the site and the remedial alternatives under consideration. Transcripts of the public meeting are included as part of the *Administrative Record* for this operable unit remedial action. The *Administrative Record* includes the information considered in deciding upon the selected remedy presented in this ROD. All public comments, oral and written, were considered in the decision-making process for determining the selected remedy (see Appendix A).

4 SITE CHARACTERISTICS

4.1 ENVIRONMENTAL SETTING

The geology and hydrogeology of the Weldon Spring area govern the rate and path of groundwater flow. Transport of contaminants within the groundwater depends on the geology and hydrogeology of the area, as well as on the physical and chemical properties of the contaminants. Land use in the surrounding areas affects the potential for human or ecological exposure to any contaminants the groundwater may contain.

4.1.1 Geology

Locally, the subsurface consists of porous, unconsolidated deposits that unconformably overlie bedrock. This unconsolidated overburden material consists primarily of modified loess, glacial drift, preglacial deposits, and residuum (DOE and DA 1997b). The thickness of these glacial and preglacial deposits, known as the "overburden," generally ranges from 4 to 18 m (13 to 59 ft) across the chemical plant area.

The Burlington-Keokuk Limestone, the uppermost bedrock unit at the chemical plant area, has been separated into two subunits, the weathered and unweathered. The weathered unit ranges in thickness from 3 to 17 m (10 to 55 ft). At the chemical plant area, fracturing in the bedrock is predominantly horizontal. Solution features are common in the weathered portion of the Burlington-Keokuk Limestone and range from pinpoint vugs to small zones of core loss, typically less than 1.5 m (5 ft). The larger zones in many cases appear to be at least partially filled with clay or clay mixture (DOE 1992). Significantly fewer horizontal and vertical fractures exist in the unweathered unit than in the weathered unit. Field data indicate a decrease in hydraulic conductivity with depth, which is attributed to decreased weathering. The size, abundance, and geometry of the open fractures within the bedrock affect the transport of groundwater and contaminants through the bedrock.

4.1.2 Hydrogeology

Three bedrock aquifers are present in the vicinity of the Weldon Spring site: a shallow unconfined aquifer (although it may be locally confined); a middle confined aquifer; and a deep confined aquifer. An additional shallow, alluvial aquifer is present near the Weldon Spring quarry adjacent to the Missouri River. In St. Charles County, the shallow and middle aquifers are used primarily for rural domestic water supply. This usage occurs outside of the influence of the groundwater contamination at the chemical plant area. The shallow alluvial aquifer near the

Missouri River supplies drinking water through the St. Charles County well field. Currently, no groundwater is used at the Weldon Spring site.

Because the shallow unconfined aquifer has been affected by former activities at the chemical plant area, it is the groundwater system of primary interest in the Weldon Spring area. This aquifer consists of the Burlington-Keokuk Limestone and the Fern Glen Formation, both limestone units, and, in some locations, the overburden. The principal recharge to this shallow groundwater system is through infiltration of precipitation from the overburden or from losing streams. The water table elevation fluctuates seasonally and with precipitation, but remains within the upper bedrock or overburden. An east-west trending groundwater divide, which coincides with the topographic highpoint of the area, results in two distinct drainage systems.

At the chemical plant area, shallow groundwater north of the divide flows to the north and into a karst conduit system that discharges at Burgermeister Spring (Figure 5). Transport through this conduit is very rapid. Water discharged at Burgermeister Spring then mixes with other surface water and with ponded water in Lake 34. Any dissolved contaminants in the discharged groundwater are then subject to extensive dilution and physical and chemical degradation. Because most of the shallow groundwater beneath the chemical plant area discharges to the surface in the vicinity of Burgermeister Spring, the spring defines the northern-most extent of direct groundwater transport from the site and provides an ideal location for monitoring end-point contaminant concentrations.

Groundwater south of the divide at the chemical plant area flows south to southeast toward the Missouri River, primarily through the Southeast Drainage. Because this drainage has losing stream segments in its upper reaches, mixing between groundwater and surface water occurs. As with Burgermeister Spring, springs in the Southeast Drainage act as end points of direct groundwater transport from the chemical plant area and provide ideal locations for monitoring groundwater contamination. Data from groundwater (MW-4026) down gradient of the springs indicate no impact.

The shallow groundwater system beneath the chemical plant area is hydrogeologically complex and is characterized by fractures, conduits, paleochannels, and dissolution/weathering features. Because of these features, the aquifer exhibits highly heterogeneous and anisotropic values in conductivity and transmissivity (ease with which a porous material allows water to flow) from place to place. Recent pump tests performed in July 1998 (MK-Ferguson 1998) to determine the effects of groundwater withdrawal on the aquifer further demonstrated the variability of the aquifer. In one location, pumping at a rate of less than 3.8 L/min (1 gallon per minute [gpm]) could not be sustained. In a second location approximately 30 m (100 ft) away, water could be pumped, but at a rate of less than 37.9 L/min (10 gpm), which is a low value from a pump and treat perspective. Even with this low rate of pumping, the shallow groundwater system could not recharge to sustain this rate, which resulted in the water level in the well falling below the depth of the pump. Once pumping stopped, recovery of the groundwater level was very slow, and full recovery to water levels prior to testing still has not been achieved.

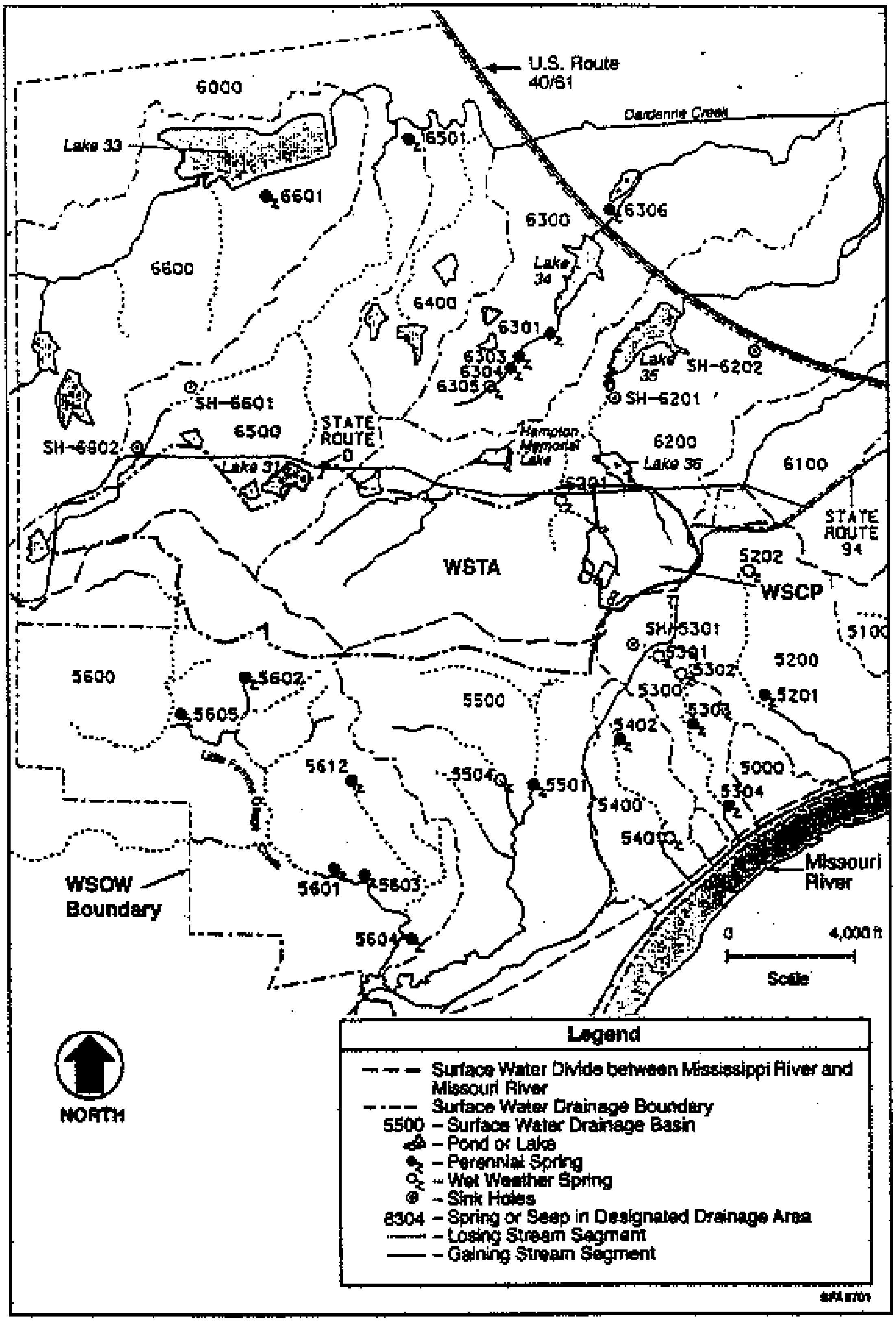


FIGURE 5 Springs and Drainage Areas in the Chemical Plant Area and the Ordnance Works Area

4.1.3 Surface Water

The chemical plant area is located on an east-west drainage divide between the Missouri and Mississippi watersheds. At the chemical plant area, surface drainage to the south of the divide generally flows through the Southeast Drainage and discharges to the Missouri River. Surface drainage to the north of the divide flows toward Dardenne Creek and its tributaries. Schote Creek, the largest of the tributaries, drains a major portion of the chemical plant area. Dardenne Creek flows east to the Mississippi River.

4.1.4 Land Use

The Weldon Spring site is located in St. Charles County, which has a population of approximately 100,000. The largest city in the county is St. Charles, which is located approximately 24 km (15 mi) northeast of the site and has a population of about 50,000 (DOE 1998b).

The chemical plant area is fenced, and access by the general public is restricted. Adjacent to the chemical plant area, portions of the Weldon Spring Training Area (WSTA) that are within the ordnance works area are currently used for field training and outdoor maneuvers by the U.S. Army Reserve, the Missouri Army National Guard, and other military and police units. An estimated 3,300 local Army reservists and 3,400 other reserve troops use the training area each year. The U.S. Department of the Army (DA) intends to continue using the WSTA for future training activities.

A large portion of the ordnance works area has been converted into conservation areas. The August A. Busch Memorial Conservation Area and the Weldon Spring Conservation Area (see Figure 2) are managed by the Missouri Department of Conservation and are open throughout the year for recreational use. These areas receive an estimated 1.2 million visitors each year.

A state highway maintenance facility just east of the chemical plant area employs nine full-time staff and one mechanic. The former staff housing complex for the ordnance works area, located southeast of the intersection of State Route 94 and U.S. Route 40/61, is currently a private housing development known as Weldon Spring Heights; it has about 80 residents.

Francis Howell High School, located about 1 km (0.6 mi) east of the chemical plant area, employs about 175 faculty and staff (including employees at the Francis Howell Administration Annex) and is attended by about 1,930 students.

4.2 NATURE AND EXTENT OF CONTAMINATION

As presented in the RI report (DOE and DA 1997b), the nature and extent of contamination within the groundwater system for the chemical plant area were jointly evaluated with those of the ordnance works area by using data collected during DOE and DA monitoring programs from 1987 through 1995 and a joint sampling effort conducted in 1995. Data for the chemical plant area and the ordnance works area were combined and evaluated together because the groundwater system is continuous beneath both areas. Data obtained since 1995 from the chemical plant area monitoring wells and springs were also reviewed and are summarized in this section to provide the latest contaminant profile.

4.2.1 Groundwater

On the basis of the results of the evaluation in the RI (DOE and DA 1997b) and BRA (DOE and DA 1997a), the primary contaminants in chemical plant area groundwater are TCE, nitrate, nitroaromatic compounds, and uranium.

TCE contamination in groundwater is a recent occurrence (i.e., 1996). Contamination is localized at the chemical plant area, primarily in the vicinity of the raffinate pits. The horizontal extent of contamination extends from east of Raffinate Pit 3 to the south and southeast of Raffinate Pit 4, just beyond the adjacent boundary with the WSTA (see Figure 3). Contamination is limited to seven monitoring wells that are open to the weathered portion of the aquifer. The TCE concentrations ranged from 0.6 to 1,300 μg/L. An analytically suspect value of 9,000 μg/L was reported in 1996 for MW-2038; however, data from this well have since been monitored to be considerably lower (i.e., approximately 1,000 μg/L).

Nitrate contamination is primarily limited to the chemical plant area and nearby vicinity. The highest concentrations of nitrate have typically been measured in the vicinity of the raffinate pits and Ash Pond (see Figure 3). Up until 1995, concentrations as high as 12,000 mg/L were detected. More recent data show a range of 0.02 to 1,000 mg/L. As expected, remediation activities in the raffinate pit area in 1998 have resulted in slight increases in contaminant concentrations in several of the vicinity wells due to the excavations being conducted at the raffinate pits. These levels are expected to decrease after source removals have been completed.

Nitroaromatic compounds occur sporadically at low levels across the groundwater system; higher levels have generally been detected in the overburden and weathered units of the aquifer. The primary nitroaromatic compounds in groundwater include 2,4-DNT, 2,6-DNT, 1,3,5-trinitrobenzene (1,3,5-TNB), 2,4,6-TNT, and the amino-DNT degradation compounds. Recently, maximum concentrations of 6.0 μg/L for 2,4-DNT; 110 μg/L for 2,6-DNT; 62 μg/L for 1,3,5-TNB; 0.32 μg/L for 1,3-dinitrobenzene (1,3-DNB); and 25 μg/L for 2,4,6-TNT have been detected.

The extent of uranium groundwater contamination, like nitrate, is primarily limited to the chemical plant area and nearby vicinity. Contamination occurs predominantly in the overburden and weathered units of the aquifer. Recent data collected for uranium in 1997 to 1998 from the 56 monitoring wells ranged from 0.02 to 55 pCi/L. The maximum concentration of 55 pCi/L was detected from a well in the raffinate pit area (MW-3024), where concentrations previously have been consistently at background levels. This well may have been affected by recent sludge removal and other remediation activities in the raffinate pit area. In addition to MW-3024, uranium concentrations at two other wells were reported at concentrations exceeding 14 pCi/L (the proposed maximum contaminant level [MCL]). These wells are MW-3003 and MW-4020, with concentrations of 17 and 20 pCi/L, respectively. Only concentrations at MW-3024 exceed the 30-pCi/L standard of Title 40, Part 192, of the *Code of Federal Regulations* (40 CFR Part 192).

4.2.2 Springwater

The primary contaminants in the springwater at surface springs around the chemical plant area are uranium, nitrate, and nitroaromatic compounds. Low levels (less than 2 μg/L) of TCE have been detected only in one spring, Spring 6303. Elevated levels of uranium and nitrate have been routinely detected at Burgermeister Spring (6300 drainage).

Nitrate concentrations at Burgermeister Spring vary with changes in flow rate, but are generally lower than concentrations measured in groundwater. Lower concentrations occur during high flow rates because of dilution. Recent data (1995–1998) for nitrate indicate a range of 3.8 to 47 mg/L.

Uranium concentrations at Burgermeister Spring sampled during higher flow rates have been reported at slightly higher levels than in groundwater because of residuals in the fractured zones. Recent levels (1997–1998) of total uranium ranged from 1.0 to 150 pCi/L. The historical maximum uranium concentration measured at Burgermeister Spring is 240 pCi/L. Elevated uranium concentrations also have been measured in the Southeast Drainage springs. The historical maximum uranium concentration at these springs is 370 pCi/L; recent levels (1997–1998) ranged from 51 to 120 pCi/L.

Nitroaromatic compounds have been detected in several springs around the chemical plant area and WSTA. Springs 5201 and 5303 (Southeast Drainage) had the highest nitroaromatic concentrations, with levels of 120 and 280 μg/L, respectively, for 2,4,6-TNT. Maximum concentrations of the other nitroaromatic compounds (1987–1995) are 11 μg/L for 2,4-DNT; 18 μg/L for 2,6-DNT; 15 μg/L for 1,3,5-TNB; 1.2 μg/L for 1,3-DNB; 1.4 μg/L for nitrobenzene; 19 μg/L for 2-amino-4,6-DNT; and 24 μg/L for 4-amino-2,6-DNT.

5 SUMMARY OF SITE RISKS

As part of the joint DOE and DA RI/FS, potential risks to human health and the environment from groundwater and springwater contamination were evaluated for the chemical plant area and the ordnance works area on the basis of current and likely future land uses. Foreseeable future land use (i.e., the next 30 years or so) at both the chemical plant area and the ordnance works area is likely to be recreational, which is the same as current land use. Accordingly, consistent with CERCLA, potential risks were estimated with reference to current and likely foreseeable future recreational users.[1] Table 1 gives the results of the human health risk assessment performed. The results of the risk assessments were used to determine areas and contaminants that may require remediation.

5.1 HUMAN HEALTH RISK ASSESSMENT

Potential cancer risks for the recreational visitor posed by exposure to radiation and chemicals were assessed by using standard methods developed by the EPA and other agencies. The EPA has established an acceptable risk range of 1 in 1 million to 1 in 10,000 (EPA 1990).

To put this risk range in context, it is estimated that about one in three Americans will develop cancer during their lifetime from all sources (American Cancer Society 1992), and that the risk of developing cancer from exposure to radiation naturally present in the environment (primarily radon) is about 1 in 100 (EPA 1989). Thus, the acceptable range is a very small percentage of the cancer risk expected in the general U.S. population from everyday exposures. For example, the incremental risk at the upper end of the EPA's range means that if all persons in a population of 10,000 were assumed to be repeatedly exposed to site contaminants, one additional person might get cancer as a result of those exposures compared with the estimated 3,000 cancer cases expected from all other exposures; that is, the number of persons who would be expected to develop cancer in that population would be 3,001 rather than 3,000.

Potential health effects other than cancer that could result from exposure to chemical contaminants were also assessed. The quantitative measure of noncarcinogenic health effects is the hazard index. The EPA has defined a hazard index of greater than 1 as indicating possible adverse noncarcinogenic health effects.

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[1] The assessment presented in the BRA (DOE and DA 1997a) also included risk estimates for a hypothetical future resident exposed to groundwater contaminants. These estimates indicate potential risks from three wells to be slightly higher than 1 in 10,000 (for a hypothetical future resident) and to be primarily attributable to TCE. Under the residential scenario, the hazard indices for several wells containing nitroaromatic compounds and nitrate also exceed 1.

TABLE 1 Summary of Human Health Risk Assessment Results for the Groundwater Operable Unit[a]

Scenario	Carcinogenic Risk: Chemical	Carcinogenic Risk: Radiological	Hazard Index
Current and foreseeable future recreational visitor	2×10^{-10} to 3×10^{-7} [b]	4×10^{-9} to 2×10^{-6} [b]	<0.001 – 0.2[b]
Hypothetical resident	6×10^{-7} to 1×10^{-3} [c]	1×10^{-7} to 7×10^{-5} [d]	0.003 – 40[e]

[a] Information presented in this table is taken from the BRA (DOE and DA 1997a). Current and foreseeable future land use were assumed to be recreational. Estimates for the current and foreseeable future recreational visitor scenario were performed for the springs only; there is no access to the groundwater under this scenario, consistent with actual site conditions. The estimates for the hypothetical resident scenario were calculated for informational purposes and assumed access to groundwater for ingestion, although currently no such access exists.

[b] The range shown represents estimates for 15 springs for the recreational visitor scenario.

[c] The range shown represents estimates for 38 of 86 monitoring wells at the chemical plant area. Estimates were not obtained for the remaining 48 wells because no levels of any carcinogenic chemical compound were detected. The upper end of this range is reported for well MW-2038, due primarily to the TCE reported. The most recent data obtained from this well, however, indicate lower concentrations, thus resulting in a lower estimate for this well (i.e., at 10^{-4}).

[d] The range shown represents estimates for 68 of 86 monitoring wells at the chemical plant area. Samples were not collected for the remaining 18 monitoring wells during the joint DOE and DA sampling rounds conducted in 1995. These wells had been reported as nondetects in sampling rounds previous to 1995. The estimates represent the potential risk for the hypothetical resident scenario for the ingestion of uranium in groundwater. The hypothetical resident scenario assumed access to groundwater for ingestion, although currently no such access exists.

[e] The range shown represents estimates for 69 of 86 monitoring wells. Data from the remaining 17 monitoring wells were reported as nondetects.

The most likely receptor for site-related groundwater contamination is a recreational visitor to the area. The assessment assumed conservatively that for 30 years the recreational visitor would visit the area 20 times a year for 4 hours each visit and each time ingest or drink 2 cups of springwater. The human health risk assessment concluded that a recreational visitor ingesting springwater from any of the 15 springs evaluated was not at risk for cancer or systemic toxicity; these results are expected to be representative of all springs in the study area. The recreational visitor was assumed not to have any exposure to the contaminated groundwater itself. This assumption is consistent with land use conditions at the chemical plant, where a recreational visitor would not have direct access to the groundwater. The risk of developing radiation-induced cancer was estimated to range from 4 in 1 billion to 2 in 1 million. These values are low and well within the acceptable risk range of 1 in 1 million to 1 in 10,000 recommended by the EPA (EPA 1989). The estimated risk for developing chemical-induced cancer is also low and ranges from 2 in 10 billion to 3 in 10 million. The hazard indices estimated for a recreational visitor at the springs ranged from less than 0.001 to 0.2.

5.2 ECOLOGICAL ASSESSMENT

The results of the ecological assessment indicate that contaminant concentrations in springwater and sediment pose little or no risk to ecological resources of the area, and that remediation from an ecological perspective is not needed.

Biotic surveys of macroinvertebrates, fish, and amphibians that inhabit the Burgermeister Spring drainage indicated no evidence of adverse effects. The spring was determined to contain generally good aquatic habitat, and the species present are typical of those found in similar habitats throughout the Midwest. Although the fish community was limited in diversity and the macroinvertebrate community was categorized as slightly impaired, the communities are likely affected by the physical nature of the spring and its drainage rather than by contaminant levels. Flow in the uppermost portion of Burgermeister Spring is maintained by groundwater discharge at the spring. Under low-flow conditions, as commonly occur in the summer, the stream drainage below the spring becomes intermittent, and portions of the habitat become dry. Surveys of amphibians found a community typical of similar habitats in the Midwest.

The results of toxicity testing of surface water and sediment indicate the potential for some toxicity to fish and macroinvertebrates from within Burgermeister Spring proper, but not downstream of the spring. However, the presence of apparently unaffected macroinvertebrate, fish, and amphibian communities in these locations suggests that local populations are tolerant of (or have adapted to) the contaminant levels present in surface water and sediment in the Burgermeister Spring drainage. Tissue analyses revealed relatively low levels of contaminant bioconcentration, all below levels of concern.

Modeling of contaminant uptake by the white-tailed deer and American robin drinking from Burgermeister Spring predicted very low levels of contaminant uptake by these species. No risk of harm was found to be caused by the modeled contaminant doses to land-based plants and animals drinking from Burgermeister Spring or other springs in the area.

Risk estimates for aquatic biota based on media concentrations indicate that surface water concentrations of iron, manganese, mercury, uranium, 1,3,5-TNB, and 2,4,6-TNT, and sediment concentrations of arsenic, lead, and silver might pose low to moderate risks to aquatic biota. However, the aquatic community in Burgermeister Spring is typical of similar habitats elsewhere in the Midwest and does not appear to be adversely affected by contaminant concentrations at this time. Few of the other springs in the area provide suitable habitat on the basis of their inherent or natural features, and, at best, support only very limited aquatic communities.

6 DESCRIPTION OF REMEDIAL ALTERNATIVES

Seven of nine preliminary alternatives were retained for detailed analysis in the FS (DOE and DA 1998) and are summarized in this chapter. These alternatives are being considered in the context of follow-on activities after source removal and control response actions have been implemented at the chemical plant area (DOE 1993).

6.1 ALTERNATIVE 1: NO ACTION

This alternative is used as a baseline against which to compare the other alternatives being considered. Under the no action alternative, groundwater at the chemical plant area would remain "as is." No containment, removal, treatment, or other mitigating actions would be implemented. The no action alternative does not include groundwater monitoring or any other active or passive institutional controls that may reduce any potential for human exposure (e.g., land use restrictions). Under Alternative 1, it is assumed that all current activities, including groundwater monitoring by DOE, would be discontinued. Contaminant concentrations are expected to decrease as a result of natural processes that will continue to occur and from current source removals being conducted per the chemical plant ROD (DOE 1993). However, monitoring will not be performed to verify the decrease in contaminant concentrations.

6.2 ALTERNATIVE 2: LONG-TERM MONITORING

Under Alternative 2, no active remediation would take place; however, long-term monitoring of the groundwater would be performed. Contaminant concentrations in groundwater at the chemical plant area are expected to decrease with time. This decrease could result from source removals and dilution from infiltration of rainwater and runoff. Further evaluation through long-term monitoring and associated activities would determine whether these processes decreased contaminant levels.

Groundwater monitoring would be conducted by using the existing monitoring well network. It is possible that this network would be expanded or reduced on the basis of subsequent design of an optimal network. Monitoring would be performed for an appropriate period of time that would be defined in the remedial design/remedial action (RD/RA) phase. As required by CERCLA, a review would be conducted every five years because contaminants would remain in site groundwater at levels above those that allow for unlimited use and unrestricted exposure.

6.3 ALTERNATIVE 3: MONITORED NATURAL ATTENUATION

This alternative involves the use of monitoring to verify the effectiveness of naturally occurring processes in the GWOU to reduce contaminant concentrations. Dilution and dispersion are the primary natural processes identified that are acting to reduce all contaminant concentrations in groundwater at the chemical plant area (DOE 1999b). However, because of the wide range in hydraulic conductivities and the karst nature of the aquifer across the contaminated areas, it is difficult to predict with any certainty the remedial time frame once source-removal actions have been completed. These source removals that are performed per the chemical plant ROD (DOE 1993) are expected to result in decreasing groundwater contaminant levels, since no further contribution to the contamination will occur. Conditions do not appear to be favorable for biological processes degrading the TCE, nitroaromatic compounds, or nitrate; however, sorption of uranium is expected to be occurring to some extent. Performance monitoring to determine continued occurrence of dilution and dispersion would be similar to that performed under Alternative 2. The monitoring activities would essentially be to verify contaminant concentration decreases at the various monitoring wells and discharge points (e.g., Burgermeister Spring).

As required by CERCLA, a review would be conducted every five years because contaminants would remain in site groundwater at levels above those that allow for unlimited use and unrestricted exposure.

6.4 ALTERNATIVE 4: GROUNDWATER REMOVAL AND ON-SITE TREATMENT USING GRANULAR ACTIVATED CARBON AND ION EXCHANGE

This alternative involves using conventional vertical extraction wells to remove contaminated groundwater. In the evaluation presented in the Supplemental FS (DOE 1999b), an estimated 24 vertical extraction wells would be required to address the contaminants at the chemical plant area to achieve a reasonable extraction rate and to provide wide enough coverage to prevent any bypass of contaminated groundwater.

The extracted groundwater would be pumped and treated at an aboveground treatment system. Organic compounds such as TCE and 2,4-DNT would be removed by using the well-established granular activated carbon (GAC) adsorption technology. Inorganic contaminants such as nitrate and uranium would be treated using ion exchange.

As required by CERCLA, a review would be conducted every five years because contaminants would remain in site groundwater at levels above those that allow for unlimited use and unrestricted exposure.

6.5 ALTERNATIVE 7: REMOVAL AND ON-SITE TREATMENT OF GROUNDWATER IN ZONES 1 AND 2

This alternative involves the extraction of groundwater in the vicinity of the raffinate pits of the chemical plant area that is primarily contaminated with TCE. In the evaluation presented in the Supplemental FS (DOE 1999b), approximately 15 vertical extraction wells were estimated to be required to achieve a reasonable extraction rate and to provide wide enough coverage to prevent any bypass of the contaminants in Zones 1 and 2. The extracted groundwater would be pumped and treated at an aboveground treatment system. TCE and nitroaromatic compounds would be removed by using the well-established GAC adsorption technology. Inorganic contaminants such as nitrate and uranium would be treated using ion exchange.

As required by CERCLA, a review would be conducted every five years because contaminants would remain in site groundwater at levels above those that allow for unlimited use and unrestricted exposure.

6.6 ALTERNATIVE 8: IN-SITU TREATMENT OF TCE USING IN-WELL VAPOR STRIPPING

In-well vapor stripping technology involves the creation of a groundwater circulation pattern and simultaneous aeration within the vapor stripping well to volatilize the TCE from the circulating groundwater. This alternative is focused on remediating the TCE-contaminated groundwater in Zones 1 and 2 that has been identified near the raffinate pits area of the chemical plant. Because of the nature of the technology involved, this alternative would not remediate the nitrate, nitroaromatic compounds, and uranium that may also be present.

The in-well vapor stripping technology consists primarily of a screened well submerged beneath the water table and an air line within the well extending to below the water table. A compressor delivers air or an inert gas such as nitrogen to the water column aerating the water within the well. The gas bubbles cause the water within the well to be less dense than the nonaerated water outside. As a result, the dense water flows in through the well screen and forces the aerated water upward within the well. The result is a rising column of aerated water within the well, which forms an air-lift pumping system.

As required by CERCLA, a review would be conducted every five years because contaminants would remain in site groundwater at levels above those that allow for unlimited use and unrestricted exposure.

6.7 ALTERNATIVE 9: IN-SITU CHEMICAL OXIDATION OF TCE USING FENTON-LIKE REAGENTS

This alternative involves in-situ chemical oxidation of the TCE-contaminated groundwater that has been identified near the raffinate pits area of the chemical plant area. Because this technology has been proven to address organic compounds only, this alternative would primarily address TCE.

The application of this technology consists of injecting aqueous solutions of hydrogen peroxide, ferrous sulfate, and other chemicals (e.g., acetic acid) into the shallow bedrock aquifer through a series of injection wells. Preliminary engineering estimates indicate the installation of approximately two sets of nested application or injection wells, with multiple rounds (at least two) of chemical reagent application.

A bench-scale test would be performed to determine the size of the area of contamination, area geochemistry, and appropriate chemical reagent formulation. The results from this bench-scale test would also support remedial design in determining the optimum number of application wells and the number of application rounds of chemical reagent. The specifics of this design would be provided in subsequent RD/RA reports.

Because of the innovative nature of this technology, combined with the complex hydrogeology of the site, the implementation of the design would be monitored for actual field versus expected performance. Rounds of chemical applications would continue to be applied beyond design specifications for so long as the application is reducing the TCE concentrations in a cost-effective manner (i.e., further reduction of TCE concentrations is exhibited and is not considered asymptotic). Conversely, the chemical application would be discontinued or terminated if reduction of TCE is not exhibited and performance is asymptotic prior to or upon full implementation of the design specifications for application rounds.

As required by CERCLA, a review would be conducted every five years because the remaining contaminants of concern would remain in site groundwater at levels above those that allow for unlimited use and unrestricted exposure.

7 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The seven final remedial action alternatives were compared with regard to the nine CERCLA evaluation criteria. The nine evaluation criteria are categorized into the following three groups, as stipulated in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (EPA 1990): threshold criteria, primary balancing criteria, and modifying criteria.

The threshold category contains the two criteria that each alternative must meet in order to be eligible for selection:

- Overall protection of human health and the environment; and
- Compliance with applicable or relevant and appropriate requirements (ARARs), unless a waiver condition applies.

These threshold criteria ensure that the remedial action selected will be protective of human health and the environment, and that the action will attain the ARARs identified at the time of the ROD or provide grounds for invoking a waiver.

The primary balancing category contains the five criteria that are used to assess the relative advantages and disadvantages of each alternative:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

Cost-effectiveness is determined by evaluating three of the five balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared with cost to ensure that the costs are proportional to the overall effectiveness of a remedial action.

The modifying category consists of:

- State acceptance, and

- Community acceptance.

The results of the comparative analysis performed for the final alternatives on the basis of the first seven criteria are summarized in Table 2. State acceptance and community acceptance are discussed in the Responsiveness Summary, which is Appendix A of this ROD.

TABLE 2 Comparative Analysis of Alternatives

	Alternative 1: No Action	Alternative 2: Long-Term Monitoring	Alternative 3: Monitored Natural Attenuation	Alternative 4: Groundwater Removal and On-Site Treatment Using GAC and Ion Exchange	Alternative 7: Removal and On-Site Treatment of Groundwater in Zones 1 and 2	Alternative 8: In-Situ Treatment of TCE Using In-Well Vapor Stripping	Alternative 9: In-Situ Chemical Oxidation of TCE Using Fenton-Like Reagents
Overall protection of human health and the environment	Like all of the alternatives, would be adequately protective of human health and the environment, although monitoring data would not be available to verify this occurrence.	Like all of the alternatives, would be adequately protective of human health and the environment. Monitoring data would be collected to verify that conditions continued to be protective of human health and the environment.	Like all of the alternatives, would be adequately protective of human health and the environment. Monitoring data would be collected to verify that conditions continued to be protective of human health and the environment.	Like all of the alternatives, would be adequately protective of human health and the environment.	Like all of the alternatives, would be adequately protective of human health and the environment.	Like all of the alternatives, would be adequately protective of human health and the environment.	Like all of the alternatives, would be adequately protective of human health and the environment.
Compliance with ARARs	Chemical-specific ARARs for TCE, nitrate, 2,4-DNT, and uranium would not be attained within a reasonable time period and would require waivers.	Complies with action- and location-specific ARARs. Chemical-specific ARARs for TCE, nitrate, 2,4-DNT, and uranium would not be attained within a reasonable time period and would require waivers.	Complies with action- and location-specific ARARs. Chemical-specific ARARs for TCE, nitrate, 2,4-DNT, and uranium would not be attained within a reasonable time period and would require waivers.	Complies with action- and location-specific ARARs. Chemical-specific ARARs for TCE, nitrate, 2,4-DNT, and uranium would not be attained within a reasonable time period and would require waivers.	Complies with action- and location-specific ARARs. Chemical-specific ARARs for TCE, nitrate, 2,4-DNT, and uranium would not be attained within a reasonable time period and would require waivers.	Complies with action- and location-specific ARARs. Chemical-specific ARARs for TCE, nitrate, 2,4-DNT, and uranium would not be attained within a reasonable time period and would require waivers.	Complies with action- and location-specific ARARs and the chemical-specific ARAR for TCE. However chemical-specific ARARs for nitrate, 2,4-DNT, and uranium would not be attained within a reasonable time period and would require waivers.
Long-term effectiveness and permanence	Is expected to afford long-term effectiveness and permanence, although investigative and monitoring activities would not be performed.	Provides for long-term effectiveness and permanence; unlike Alternative 1, would provide verification monitoring of the groundwater within the operable unit.	Provides for long-term effectiveness and permanence. Verification monitoring data would be collected.	Affords long-term effectiveness and permanence because contaminant concentrations would be removed or reduced through extraction and treatment.	Would reduce concentrations of TCE, nitrate, nitroaromatic compounds, and uranium present in Zones 1 and 2. Natural processes and source removals per the chemical plant ROD (DOE 1993) are expected to result in decreases of contaminant levels in the remaining zones.	TCE in Zones 1 and 2 would be reduced or removed by treatment of groundwater. Natural processes and source removals per the chemical plant ROD (DOE 1993) are expected to result in decreases of contaminant levels in the remaining zones.	TCE in Zones 1 and 2 would be reduced or removed. Natural processes and source removals per the chemical plant ROD (DOE 1993) are expected to result in decreases of contaminant levels in the remaining zones.
Reduction of toxicity, mobility, or volume through treatment	No reduction of toxicity, mobility, or volume through treatment would be accomplished because the contaminated groundwater would not be treated.	No reduction of toxicity, mobility, or volume through treatment would be accomplished because the contaminated groundwater would not be treated.	No reduction of toxicity, mobility, or volume through treatment would be accomplished because the contaminated groundwater would not be treated.	Reduction of the toxicity, mobility, or volume associated with all groundwater contamination within the shallow bedrock aquifer would be accomplished upon successful implementation of this alternative.	Reduction of the toxicity, mobility, or volume associated with TCE, nitrate, nitroaromatic compounds, and uranium in Zones 1 and 2 would be accomplished upon successful implementation of this alternative.	Reduction of the toxicity, mobility, or volume associated with TCE contamination at the chemical plant area (Zones 1 and 2) would be accomplished upon successful implementation of the alternative.	Reduction of the toxicity, mobility, or volume associated with TCE contamination at the chemical plant area (Zones 1 and 2) would be accomplished upon successful implementation of this alternative.

TABLE 2 (Cont.)

	Alternative 1: No Action	Alternative 2: Long-Term Monitoring	Alternative 3: Monitored Natural Attenuation	Alternative 4: Groundwater Removal and On-Site Treatment Using GAC and Ion Exchange	Alternative 7: Removal and On-Site Treatment of Groundwater in Zones 1 and 2	Alternative 8: In-Situ Treatment of TCE Using In-Well Vapor Stripping	Alternative 9: In-Situ Chemical Oxidation of TCE Using Fenton-Like Reagents
Short-term effectiveness	No potential impacts on workers or the environment because no activities would be undertaken.	Potential impacts are expected to be low, with less than one case of occupational injury and no occupational fatalities during proposed monitoring well construction. Any potential short-term environmental impacts would be limited to the immediate vicinity of the operable unit, and mitigative measures would be implemented to ensure minimal impacts to off-site areas.	The same as Alternative 2.	Potential impacts associated with construction of the extraction wells. Construction activities are estimated to result in up to seven cases of occupational injury and less than one occupational fatality. Any potential short-term environmental impacts would be limited to the immediate vicinity of the operable unit, and mitigative measures would be applied to ensure minimal impacts to off-site areas.	Expected to be low, with less than five cases of occupational injury and no occupational fatalities during operations and well construction activities. Any potential short-term environmental impacts would be limited to the immediate vicinity of the operable unit, and mitigative measures would be applied to ensure minimal impacts to off-site areas.	The same as Alternative 7.	The same as Alternative 7.
Implementability	No implementability concerns because no action would be taken nor would any future activities be considered.	Few implementability concerns because of the limited actions taken. Current monitoring operations would continue with the use of readily available resources.	The same as Alternative 2.	Uncertainties with implementation of this alternative are associated with the complex hydrogeologic characteristics of the site and the state of current technology. Uncertainties are also associated with the need for location (or area)-specific hydrogeologic data to verify the appropriateness of assumptions applied in the evaluations. Groundwater treatment technologies have been demonstrated at full-scale implementation for similar contaminants.	Uncertainties with implementation of this alternative are associated with the complex hydrogeologic characteristics of the site and the state of current technology. Specific hydrogeologic data indicate dewatering and very slow recovery of the aquifer as observed from the recent pump test (MK-Ferguson 1998) performed in the area of Zones 1 and 2.	Uncertainties with implementation of this alternative are associated with the complex hydrogeologic characteristics of the site and the state of current technology. The generation of a vertical circulation pattern is expected to be difficult.	The ability to introduce materials into Zones 1 and 2 was indicated by the pump test performed. Implementation of the technology for this alternative requires introducing a chemical reagent into the aquifer.
Cost	Lowest future cost.	Annual monitoring costs are estimated to be \$0.4 million, and capital costs are estimated to be \$0.3 million primarily for construction of additional wells.	Capital costs of approximately \$0.3 million, primarily for construction of additional wells. The present-worth cost is estimated to range between \$3 million and \$4 million.	On the basis of an estimate of 24 extraction wells, capital costs are estimated to be approximately \$7 million, with the present-worth cost estimated to range between \$15 million and \$24 million.	Capital costs are estimated to be approximately \$5 million, with the present-worth cost estimated to range between \$14 million and \$20 million. Provides some increases in protection via mass reduction in Zones 1 and 2.	Capital cost estimated to range between \$1 million and \$3 million. Annual costs are estimated to be \$0.4 million for monitoring.	Lowest cost as compared with other TCE treatment alternatives (Alternatives 7 and 8); capital cost estimated to be approximately \$0.5 million and includes the material costs of the chemical reagents. Annual costs are estimated to be \$0.4 million and are associated with groundwater monitoring. This alternative provides an increase in protectiveness via mass reduction of TCE that is proportional to the cost.

8 SELECTED REMEDY

The selected remedy provides for active remediation of the TCE-contaminated groundwater in Zones 1 and 2 via in-situ chemical oxidation as described in Alternative 9, combined with long-term monitoring for natural attenuation of groundwater and springs at the chemical plant area as described in Alternative 3.

The treatment method involves introducing Fenton-like reagents (e.g., hydrogen peroxide and a ferrous compound) into the groundwater as a means of treating TCE in place. Once introduced into the aquifer, the chemicals will produce hydroxyl radicals under controlled acidic conditions. These highly reactive radicals will then be expected to react with the TCE in the groundwater to form innocuous end products (i.e., chloride salts, carbon dioxide, and water). This chemical reaction can be completed in a relatively short period of time (days), once injection is achieved. The period of time required for remediation by using this technology is estimated to be on the order of a few months.

Long-term monitoring of an optimized network of wells and springs will generate the necessary data to verify assumptions and ensure continued protection. The long-term monitoring and assessment strategy is to collect data to verify that the contaminated zones are not progressing and that contaminant levels are diminishing with time. The decrease in contaminant concentrations is expected as a result of the source removals performed under the chemical plant ROD (DOE 1993) and the continued occurrence of natural processes, primarily dilution and dispersion.

The selected remedy was developed after careful consideration of a full range of treatment technologies and remedial options. Because of geochemical constraints and the karstic nature of the hydrogeology, it is not technically practicable to achieve ARARs (MCLs) throughout the contaminated zones in a reasonable time frame using any of the remedial alternatives that were evaluated. However, it is considered feasible to effect some localized cleanup in certain contaminated zones where the aquifer yields are uncharacteristically high. When evaluated against the remedy selection criteria defined in the NCP (EPA 1990), Alternative 9 (in-situ chemical oxidation of the TCE in Zones 1 and 2) is the best option for localized remediation because it offers the greatest potential for short-term reduction of the TCE, which is the primary driver of potential risk, and can be implemented quickly and cost effectively relative to pump and treat options. Although current site conditions are protective for recreational use (the most likely future use), successful in-situ treatment of the TCE will eliminate or decrease TCE concentrations and will result in risk estimates falling within the acceptable risk range for the hypothetical residential scenario as well.

Localized pump and treat options for other contaminants are not proposed because technical practicability is highly uncertain, and even optimal performance will not substantially decrease remediation time frames over that of natural attenuation processes. The uncertainty is associated primarily with the complex hydrogeology and heterogeneous geology of the site. Investigations indicate that the sustainable yield from the Burlington-Keokuk Limestone ranges from 1.2 L/min (0.3 gpm) up to less than 37.9 L/min (10 gpm). Previous investigations indicated that the average sustainable yield from wells constructed in both the weathered and unweathered portions of the Burlington-Keokuk Limestone is 1.2 L/min (0.3 gpm). This particular characteristic of the aquifer results in implementability limitations where contaminants occur in both units.

A long-term pump test was performed in the area of TCE-contaminated groundwater to assess the effects of groundwater withdrawal in a more conductive portion of the weathered Burlington-Keokuk Limestone. This test indicated that although the aquifer south of Raffinate Pits 3 and 4 was more transmissive than previously estimated, recharge is limited by structural controls, which results in dewatering of the area. Groundwater was withdrawn during the test at a rate of approximately 37.9 L/min (10 gpm); however, on the basis of drawdown in the pumping well, this rate could not be sustained for an extended period. This information, in addition to other hydrogeologic parameters estimated from this field study, was useful in assessing the implementability of the pump and treat technology and ultimately led to the determination that a pump and treat technology is not technically practicable.

Natural attenuation is proposed as a component of the remedy because the available information indicates that the zones of contamination are stable (i.e., they are not expanding), that contaminant levels will diminish with time at a rate comparable to that achieved through any active measures, and that this stability and reduction in contaminant levels can be demonstrated or confirmed through empirical and statistical methods. While natural attenuation is considered an important component of the proposed remedy, it is recognized that certain expectations generally associated with natural attentuation remedies will not be achieved in this circumstance. As with the active remedial methods that were evaluated, this approach is not expected to result in the achievement of ARARs (MCLs) throughout the contaminated zones over a time frame that can be planned for. Also, sophisticated groundwater modeling is not proposed because complex hydrogeological conditions and the mechanisms of attenuation limit the usefulness of this approach.

Details of the optimum monitoring network of wells, the monitoring scheme, and the in-situ chemical oxidation process will be presented in remedial design planning documents developed subsequent to the ROD. As required by CERCLA, a review will be conducted every five years because contaminants will remain in site groundwater at levels above those that allow for unlimited use and unrestricted exposure.

The selected remedy is considered protective because there is no direct exposure to groundwater under current and foreseeable land uses, that is, land use is expected to remain recreational. However, since the groundwater has been defined by the EPA as potentially useable (EPA 1986; MK-Ferguson 1990), deed restrictions or other institutional controls will be implemented as part of the selected remedy to ensure against the potential use of the groundwater for drinking water purposes.

ARARs

The following MCLs or more stringent state standards are considered chemical-specific ARARs for the contaminated groundwater:

Chemical	ARAR
Nitrate	10 mg/L
TCE	5 µg/L
Nitrobenzene	17 µg/L
2,4-DNT	0.11 µg/L
1,3-DNB	1 µg/L
Uranium	30 pCi/L

Current groundwater levels for nitrobenzene and 1,3-DNB meet their respective ARARs. The proposed MCL of 20 µg/L for uranium is regarded as a to-be-considered requirement (TBC) for this action.

Risk-based concentrations for the other nitroaromatic compounds of concern were calculated and used as benchmarks in the evaluation. Risk-based concentrations for 1,3,5-TNB, 2,4,6-TNT, and 2,6-DNT are 1.8 µg/L, 2.8 µg/L, and 0.13 µg/L, respectively. Current groundwater concentrations at the chemical plant area exceed these risk-based values.

With respect to nitrate, 2,4-DNT, and uranium, the state of the current technology and the complex hydrogeologic characteristics of the site render compliance with identified ARARs as technically impracticable. The risk-based concentrations for 1,3,5-TNB, 2,4,6-TNT, and 2,6-DNT could not be attained for the same reasons as those given for nitrate, 2,4-DNT, and uranium. A number of factors associated with the shallow groundwater system beneath the chemical plant area are strong indicators that it would be technically impracticable to achieve reduction of the contaminant levels to meet ARARs and risk-based benchmarks within a reasonable time frame. These factors are as follows:

- The hydrogeology present in the shallow groundwater system is highly complex and unfavorable (i.e., karst features such as paleochannels, conduits, fractures, weathering, and dissolution features) for remediation using extraction methods;

- The hydraulic conductivity of the shallow groundwater system is highly heterogeneous and anisotropic;

- Sustainable yield (i.e., the maximum rate of groundwater removal that can be sustained by pumping without dewatering the groundwater system) is low (<37.9 L/min [<10 gpm]);

- The area of influence of the extraction well is structurally controlled;

- The distribution of contaminants is complex (i.e., multiple historical sources introduced into a complex shallow groundwater system) and, in general, of low concentration;

- In spite of source removal at the ground surface, contaminants are likely to be present in residual but irremovable quantities in the karst features beneath the chemical plant area;

- Cleanup times estimated by using very optimistic extraction rates are still excessively long (i.e., hundreds to thousands of years, depending on the contaminant of concern); and

- Pumping tests performed at the site demonstrated that cleanup times would be excessive because of low yields, long recovery times for groundwater levels, and a high potential for dewatering the adjacent porous medium.

Accordingly, the ARARs for nitrate, 2,4-DNT, and uranium for all the contaminated zones are being waived on the basis of technical impracticability (TI) per Section 121(d)(4) of CERCLA and Section 300.430 of the NCP (EPA 1990).

With respect to TCE, it is intended that the selected remedy will achieve the ARAR for TCE in Zones 1 and 2 (TCE has not been detected at the remaining zones). However, considerable uncertainty is associated with achieving this goal because of the innovative nature of the technology and the complex hydrogeologic characteristics of Zones 1 and 2. Since the Supplemental FS (DOE 1999b) established that the pump and treat option is not effective for Zones 1 and 2, if the ARAR for TCE is not achieved after completion of the treatment component in accordance with the RD/RA work plan, a waiver of the ARAR for TCE in Zones 1 and 2 will be appropriate. Long-term monitoring of further natural attenuation of the TCE will be performed, similar to that planned for nitrate, 2,4-DNT, and uranium.

9 STATUTORY DETERMINATIONS

In accordance with the statutory requirements of Section 121 of CERCLA, as amended, remedial actions shall be selected that:

- Are protective of human health and the environment,
- Comply with ARARs unless waiver conditions apply,
- Are cost-effective, and
- Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

The selected remedy is discussed below in relation to how it fulfills the requirements. In addition, the preference cited in CERCLA Section 121 for treatment as a principal element is discussed.

9.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy will be protective of human health and the environment. Because source removal has been accomplished under the chemical plant ROD (DOE 1993), no new migration of contaminants to the groundwater system should occur. Long-term monitoring will be used to confirm expectations that contaminant concentrations will decrease over time and that the contaminated zones are not progressing. Reduction of TCE levels in Zones 1 and 2 will also be accomplished under this action.

9.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

As required by Section 121(d)(4) of CERCLA, the selected remedy will comply with all action- and location-specific ARARs. In addition, the selected remedy will comply with the chemical-specific ARARs for TCE. Waivers based on TI are being applied to the chemical-specific ARARs for nitrate, 2,4-DNT, and uranium.

9.2.1 Chemical-Specific ARARs

Chemical-specific ARARs set concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants of concern. MCLs for TCE and nitrate of 5 μg/L and 10 mg/L, respectively, are chemical-specific ARARs. Current concentrations in groundwater at the chemical plant area exceed these ARARs. The groundwater standard for uranium identified in 40 CFR Part 192 is considered a chemical-specific ARAR for uranium. Uranium concentrations in one well currently exceed this ARAR. Missouri water quality standards in groundwater for nitrobenzene (17 μg/L), 2,4-DNT (0.11 μ/L), and 1,3-DNB (1.0 μg/L) are chemical-specific ARARs for chemical plant groundwater. Current levels of 2,4-DNT in chemical plant area groundwater exceed the ARAR. Current levels of nitrobenzene and 1,3-DNB meet ARARs.

9.2.2 Action-Specific ARARs

Action-specific ARARs are standards that restrict or control specific remedial activities related to the management of hazardous substances or pollutants for a variety of media. These requirements are triggered by a particular activity, not by specific chemicals or the location of the activity. Several action-specific ARARs may exist for any specific action. These action-specific ARARs do not in themselves determine the appropriate remedial alternative, but indicate performance levels to be achieved for the activities performed under the selected remedy. On-site actions must comply with all substantive provisions of an ARAR, but not with related administrative and procedural requirements (e.g., filing reports or obtaining a permit). The term "on-site" includes the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary to implement the response action. No permit applications will be necessary for any on-site activities. The selected remedy will comply with all pertinent action-specific ARARs, which are listed in Appendix A of the FS (DOE and DA 1998) and summarized below.

All activities that may result in the disturbance of media contaminated with radionuclides (e.g., well construction) will conform to the operational standards for uranium and thorium mill tailings promulgated by the EPA (40 CFR 192, Subparts D and E) that establish certain annual dose limitations for exposure to radiation. Although not applicable to Weldon Spring site activities, these requirements are relevant and appropriate to these activities because they specifically address exposures of workers to radiation associated with the same radionuclides during remediation activities. Similarly, radiation exposure limits for the public established in Missouri Radiation Regulations, Protection Against Ionizing Radiation (Title 19, Part 20-10.040, et al., of the *Code of State Regulations* [19 CSR 20-10.040, et al.]), as they apply to nonoccupational exposures, are ARARs with which the selected remedy will comply.

In addition, any release of radionuclides to the ambient air during soil excavation activities (such as those associated with monitoring well installation and application) will comply with the limitations set forth in the EPA's National Emission Standards for Hazardous Air Pollutants (40 CFR 61, Subpart H). Similarly, the release of particulate matter during other earth-disturbing activities must comply with Missouri Air Pollution Control Regulations (10 CSR 10-5.180 and 10-6.170). Missouri requirements for well construction will be an ARAR for any newly installed wells or for the plugging of wells under the selected remedy (10 CSR 23-4.050).

Appendix A of the FS (DOE and DA 1998) also lists several regulations that set occupational exposure limits for activities involving media contaminated with radionuclides, including the Missouri Radiation Regulations, Protection Against Ionizing Radiation (19 CSR 20-10.040, et al.); Occupational Safety and Health Administration Environmental Controls (29 CFR 1910, Subpart G); and DOE Occupational Radiation Protection (10 CFR 835). These regulations are not ARARs because they are not environmental or siting regulations; however, as employee protection regulations, these requirements must be complied with by employees working with contaminated media or in contaminated areas.

DOE Order 5400.5 (DOE 1990a), "Radiation Protection of the Public and the Environment," has been established as a TBC. Because DOE Orders are not promulgated regulations, they are not ARARs but are considered as TBCs. The selected remedy will comply with all pertinent DOE Orders.

9.3 COST-EFFECTIVENESS

The selected remedy will be cost-effective because it provides overall protection of human health and the environment at a reasonable cost. Costs are associated primarily with activities associated with long-term monitoring of groundwater and springs.

9.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site.

9.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

By treating TCE in the groundwater, the selected remedy addresses principal threats posed by the groundwater at the chemical plant area through the use of treatment technologies. By utilizing treatment as a portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

The selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering state and community acceptance.

9.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The implementation of the selected remedy will not result in permanent commitment of land at the chemical plant area. Current and future land use at the chemical plant area will not have to change as a result of the implementation of this action.

9.7 SIGNIFICANT CHANGES

The PP (DOE 1999a) for the chemical plant GWOU was released for public comment on August 3, 1999. The PP identified Alternative 9, combined with Alternative 3, as the Preferred Alternative for addressing groundwater contamination. The DOE and EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the PP, were necessary or appropriate.

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APPENDIX A:

RESPONSIVENESS SUMMARY

APPENDIX A:

RESPONSIVENESS SUMMARY

The *Proposed Plan* (DOE 1999a) for the Groundwater Operable Unit (GWOU) was issued to the public for review and comment on August 3, 1999. The U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) held a public meeting to discuss the proposed action on August 25, 1999, at the Administration Building of the Weldon Spring Site Remedial Action Project (WSSRAP) located at 7295 Highway 94 South, St. Charles, Missouri. Representatives of the State of Missouri were also in attendance. The DOE and the EPA responded to oral comments made on the *Proposed Plan* (DOE 1999a) at this meeting; those responses are included in the meeting transcript. The meeting transcript is part of the *Administrative Record* for the GWOU and is on file at the information repositories for the WSSRAP. The repositories are located in the project office reading room at Francis Howell High School and at four branches of the St. Charles City/County Library, as listed in Section 3 of this Record of Decision (ROD).

The 30-day public comment period for the *Proposed Plan* (DOE 1999a) ended on September 1, 1999. In addition to oral comments received and responded to at the public meeting, comment letters were received from the Missouri Department of Health (MDOH); Michael Garvey of St. Peters, Missouri; the Missouri Department of Natural Resources (MDNR); Kay Drey of University City, Missouri; and Mary Halliday of the St. Charles County Government. These letters are also part of the *Administrative Record* for the GWOU. In this responsiveness summary, the comment letters are referred to by an alphabetical identifier determined by the order in which they were received by the project office. Each comment letter has been reproduced to provide detailed responses to comments or issues raised in the individual letters.

MISSOURI DEPARTMENT OF HEALTH

Mel Carnahan
Governor

Maureen E. Dempsey, M.D.
Director

P.O. Box 570, Jefferson City, MO 65102-0570 • 573/751-6400 • FAX 573/751-6010

August 24, 1999

Stephen H. McCracken
Weldon Spring Site
U.S. Department of Energy
7295 Highway 94 South
St. Charles, MO 63304

Re: Final Proposed Plan for Remedial Action for the Groundwater Operable Unit (GWOU) at the Chemical Plant Area of the Weldon Spring Site (July 1999).

Dear Mr. McCracken:

The Missouri Department of Health (MDOH) would like to take this opportunity to comment on the Final Proposed Plan for the GWOU at the chemical plant area of the Weldon Spring Site submitted by the U.S. Department of Energy (DOE).

The remedial action proposed is a combination of chemical oxidation and monitored natural attenuation (MNA). Chemical oxidation would involve the injection of acetic acid, ferrous sulfate, and hydrogen peroxide to produce hydroxyl radicals that react with trichloroethylene (TCE) and other organic compounds. MNA would rely on dilution and dispersion to lower the other contaminants of concern to maximum contaminant levels (MCLs). The Proposed Plan concludes by stating that the Record of Decision (ROD) will contain waivers for nitrate and 2,4-DNT due to Technical Impracticability (TI). The Proposed Plan also indicates that if chemical oxidation is not successful, then a waiver would be appropriate for TCE.

A-1 The Proposed Plan states that the reasoning for TI is based on limits in technology and the complex hydrogeologic characteristics of the site. The Supplemental to the Feasibility Study indicates that the cleanup times for pump and treat (Table 3) are based on the Javandel and Tsang method to calculate a minimum number of extraction wells to contain a plume. The cleanup times are therefore based on extraction wells that are at the edge of the contamination zone, making the cleanup times conservatively long. MDOH would like to see cleanup estimates based on optimal performance (i.e., extraction wells at hot spots). This would make the cleanup times much quicker and improve the implementability of pump and treat alternatives.

A-2 The proposed remedial action does not include groundwater extraction because of dewatering and slow recovery of the aquifer and refers to the Completion Report for the Pilot Pumping Test (October 1998) (CRPPT) in Table 4 of the Proposed Plan. However, the CRPPT indicates (Section 5.4.4 of the CRPPT) that a yield of 10.7 gpm can be maintained if the aquifer were artificially recharged upgradient. Pump and treat systems can successfully operate at this level of yield by reinjection of the treatment stream into the aquifer. MDOH would like to see DOE address the possibility of reinjection or pulsed pumping as possible enhancements to the extraction alternatives.

A-3 The proposed waiver for nitrate and 2,4-DNT is, according to the Proposed Plan, based on TI. However, according to cleanup times in Table 3, there are several other contaminants that have cleanup times that are just as long as nitrate and 2,4-DNT. Please clarify whether there is the potential for future proposed waivers for other contaminants because of the long cleanup times.

A-4 Chemical oxidation is the active remediation portion of the Proposed Plan. The process uses chemical injection into the aquifer to produce hydroxyl radicals to break down TCE. Possible by-products, as stated in the Feasibility Study (December, 1998), include tetrachloroethane, trichloroethane, dichloropropene, chloroform, and carbon tetrachloride. If chemical oxidation is retained, then DOE should analyze for possible by-products, as well

Response A-1

Any further attempt to optimize the design, as suggested in the comments, would not be useful since the results would not be applicable to site conditions. There is no scientifically defensible methodology currently available to evaluate a pump and treat design for a karstic hydrogeology such as that present at the chemical plant area. The approach for evaluating the pump and treat option as presented in the Feasibility Study (FS) (DOE and DA 1998) and the Supplemental FS (DOE 1999b) was, by necessity, based on an ideal homogeneous porous medium. This was done to provide an adequate and scientifically defensible approach for comparing the pump and treat alternative with the other alternatives developed in the FS and the Supplemental FS. The design placed extraction wells along the edge of the contaminated zone to provide adequate containment of the contaminants in that zone. This approach, however, is not applicable to the hydrogeologic conditions at the chemical plant area and already presents an unrealistically optimistic scenario for comparison in the FS and Supplemental FS. The results of the calculations in the FS and Supplemental FS indicate that even under these optimistic assumptions, it would still require long cleanup times to achieve ARARs using the pump and treat option.

Response A-2

During the pilot pump test (MK-Ferguson 1998), two wells were evaluated as extraction points. Both wells were selected because of their locations within the boundaries of a potential paleochannel that will provide high yields of groundwater. The first well tested produced water at a rate of less than 3.8 L/min (1 gallon per minute [gpm]). The second well produced water with a yield of 37.9 L/min (10.7 gpm) for approximately two weeks. At the end of this time period, the drawdown in the well was greater than the thickness of the more permeable zone, and the aquifer was rapidly dewatering. As suggested in the comment, reinjection or pulsed pumping could be used to alleviate the problems associated with this dewatering. However, because of the karst hydrogeology present at the chemical plant area, reinjection would be unreliable. That is, the reinjected water could bypass the extraction well by traveling in another karst feature, thus potentially spreading the extent of contamination to areas not currently affected. Pulsed pumping, under ideal conditions, could also be used to limit the degree of aquifer dewatering. Field results from the pilot pump test, however, indicate that pulsed pumping in the chemical plant area would not be successful because of the very long recovery times (i.e., water levels in the pumped well have not recovered to their initial value after a year of rest).

Response A-3

The contaminants other than nitrate, 2,4-dinitrotoluene (2,4-DNT), and uranium do not have applicable or relevant and appropriate requirements (ARARs) associated with them. Accordingly, waivers are not required. However, as stated in the comment, cleanup times for these other contaminants are equally long, and the risk-based concentrations presented in the FS (DOE and DA 1998) and Supplemental FS (DOE 1999b) for these contaminants would not be attainable within a reasonable time frame.

Stephen H. McCracken
August 19, 1999
Page 2

A-4 as pH and injection products. MDOH is concerned with the level of effort needed for chemical oxidation to remediate TCE. The process could take several rounds of injection and testing to bring TCE levels down to the MCL. With the potential of waivers for TCE if chemical injection does not work, MDOH is concerned with the amount of work required to see the remediation through. The ROD should state how many rounds of chemical injection will be performed before the remedial action is conceded.

A-5 The remedial action proposed relies heavily on MNA. EPA's Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, gives guidance on the use of MNA and is referenced in the Proposed Plan. The EPA document raises concerns with the use of MNA in a karst environment and cites the high degree of effort needed for adequate monitoring in this situation. MDOH is concerned that the existance of paleochannels beneath the chemical plant is being viewed as a benefit to MNA due to increased dilution. However, since the CRPPT indicates that the recharge of the shallow aquifer is very slow then dilution is considerably reduced. Therefore, the potential for rapid transport of contamination further supports the use of other remedial alternatives in conjunction with MNA (i.e., source control with MNA). MDOH applauds the proposed active remediation of TCE; but wishes to see alternatives in the final plan that also deal with the other contaminants that are above MCLs.

A-6 EPA has established that groundwater clean-up levels are to be based on residential risk-based scenarios because of the potential future use of the groundwater aquifer. Because of the importance of possible future use of the groundwater, MDOH would discourage the use of waivers without more supporting documentation. Although we would like to see the remedial action move along in a timely fashion, we are not against taking time to re-evaluate remedial alternatives in the hope of avoiding the use of unwarranted waivers at the site.

We appreciate the opportunity to participate in this matter. If you have any questions, please contact Mr. Chuck Hooper at (573) 751-6404

Sincerely,

Daryl W. Roberts, Director
Section for Environmental Public Health

DWR:SAC:RDM:CAH/mdh

cc: Dan Wall, EPA
Larry Erikson, MDNR

Response A-4

The remediation of trichloroethylene (TCE) via in-place chemical oxidation will be designed to attain the ARAR of 5 µg/L for TCE in the groundwater. A bench-scale test will be performed to determine specific input to the remedial design, such as the number of application wells needed, the proper chemical reagent formulation, and the number of times of reagent application. Sampling and analysis of groundwater during the remedial action will be performed to test for TCE and by-products, reagent residuals, and relevant geochemical parameters. The specifics of the remedial design will be presented in subsequent remedial design/remedial action reports. Text has been added to this ROD to describe the conditions under which the remedial action would be either continued or terminated (see Section 6.7 of ROD).

Response A-5

As discussed in the *Proposed Plan* (DOE 1999a) and this ROD, the comparative analysis of alternatives performed for the GWOU at the chemical plant area indicates that this proposed action is the best option. Monitored natural attenuation is proposed as part of the remedial action for the GWOU and is being considered as the follow-on action after source removal or source control (i.e., as a follow-on remedial action to the remedial action stipulated in the chemical plant ROD [DOE 1993]).

Response A-6

The components that demonstrate technical impracticability (TI) have been presented in the Remedial Investigation and Feasibility Study (RI/FS) reports (DOE and DA 1997a,b, 1998; DOE 1999a,b) prepared for the GWOU of the chemical plant area. This is consistent with EPA Region VII guidance for determining TI. See Responses A-3 and A-5.

GARVEY Team Orthodontics, P.C.

Stephen H. McCracken
Dept. of Energy Weldon Spring Site
7295 Highway 94 South
St. Charles, MO. 63304

Re: Comment for inclusion in Record of Decision of Groundwater Unit under Chemical Plant Proper
Sent via Fax to #636-447-00739
Aug. 31, 1999

Dear Steve,

I appreciate the opportunity to comment on the Groundwater Unit for the ROD. In addition to the comments made at the Public Meeting please consider this correspondence.

In general I have been pleased with the entire scope of the Remediation and with your open dialogue with the public. A major improvement by the DOE in this regard was needed and obtained largely as a result of public pressure early on in the process.

B-1 Source reduction and isolation in the disposal cell has greatly improved the future impact of the contaminants to the groundwater and surface water. Of source this is only the case in the distant future with containment as a result of integrity of the liners and clay barriers of the cell. The Disposal Cell & Leachate collection system will not effectively function over time as compared with the half life of lets say uranium.

B-2 Although the decision was made, I was and still am not comfortable with the final move to build the cell at the same site as the plant for two reasons. First the poor groundwater quality at the site from the very same chemicals which are placed in the cell, making assessment of leaks in the cell more difficult and secondly, due to the complex hydrology and heterogeneous geology. B-3 I have a problem with DOE now stating that to be the case in the final evaluation of the most difficult and complex decision namely the groundwater. Relying on dilution over time to dissipate the groundwater of both radionuclides and volatiles is hardly the best available technology. Although the pump tests showed that maintenance of flow was sporadic the problem could be alleviated if some of the other wells were used to pump water into the system. The Mo DNR has recommended this to be done. The area immediately under the raffinate pits may need to have wells placed for treatment of the groundwater in those locations.

DIPLOMATE, AMERICAN BOARD OF ORTHODONTICS

Michael V. Garvey, D.D.S., M.S. 2967 Old Hwy. 94, St. Peters, MO 63376, Ph. 441-2770

023681

SEP - 1 1999

Response B-1

Comment noted. The disposal cell and leachate collection system have been designed to meet appropriate provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and Resource Conservation and Recovery Act (RCRA) requirements and is expected to be protective of human health and the environment.

Response B-2

A number of provisions have been incorporated into the design of the disposal cell to provide information on a system failure. These provisions include a primary system, a secondary leachate collection system, monitoring wells situated in the immediate vicinity of the disposal cell, a network of downgradient monitoring wells, and monitored springs (in particular, Burgermeister Spring near Lake 34). The most valuable information on a disposal cell failure will come from those detectors closest to the point of failure in a complex hydrogeology. In this case, these detectors will be either the primary or secondary leak detection systems. The least important detectors will be remote, downgradient wells. Although these wells will provide the least timely information, a failure of the cell could be detected in these wells or at the monitored springs in spite of the contaminated groundwater. This detection will be in the form of an abrupt increase of contaminant concentrations with a signature (chemical composition) and contaminant arrival times akin to the leachate generated in the cell. Contaminant concentrations of the contaminants of concern identified for the GWOU, however, are expected to monotonically decrease with time due to source removal.

Response B-3

As suggested in the comment, artificial recharge could be used to maintain flow in extraction wells. However, site-specific problems associated with reinjection (see Response A-2) preclude its utility at the chemical plant area.

GARVEY Team Orthodontics, P.C.

Page 2 DOE Groundwater ROD
8-31-1999

B-4 I question whether the conditions will be adequately acidic as a result of the limestone
to cause the Fenton reagent to be activated. Will the TCE be tested after the process
B-5 for effectiveness? Who will insure the the land use is maintained a recreational and
no wells placed? Regardless of the source of the radionuclides, will the Dept. of
B-6 healths private wells which have been tested be used in characterization of the
radiologic/volatile plumes at off site locations? Will DOE consider Remediation of off
B-7 site groundwater ie Busch WLA?

Without a timetable and plan for the wells and surface waters to be used in long term
monitoring in place; it is unsettling for citizens who will be living in the area. Also with
the lack of commitment financially regarding the costs of the long term monitoring to be
in place one has to rightfully question if in fact long term monitoring will be done. As I
and the citizen group mentioned in the public meeting, a local person employed or
B-8 working perhaps part time to monitor and maintain the site would be a request. Also
what will be the criteria used to reevaluate the monitoring each 5 years?

I realize that these are numerous and difficult questions but feel that the citizens deserve answers. Again as mentioned I am very grateful to DOE for the excellent Remediation and on the whole you and the DOE should feel proud to have taken over in the needed stewardship of the land for the benefit to the population.

Sincerely,

Michael V. Garvey
cc Joe Ortwerth St. Charles County Executive
cc Stan Remington County Consultant
cc Daniel Wall EPA
cc Mark Flaspohler MDOC
cc Brandon B. Doster MDNR
cc Kay Drey Coalition for the Environment
cc Board Greenway Network, Inc

DIPLOMATE, AMERICAN BOARD OF ORTHODONTICS

Michael V. Garvey, D.D.S., M.S. 2967 Old Hwy. 94, St. Peters, MO 63376, Ph. 441-2777

Response B-4

A bench-scale test will be performed to support remedial design activities for the in-place chemical oxidation of the TCE in groundwater at the chemical plant area. On the basis of the information obtained from the bench-scale test, a certain number of application wells and rounds of chemical reagent application will be determined that will be adequate to treat the TCE to 5 ug/L. It is expected that at least the first round of reagent application will react with and perhaps be neutralized by the limestone that is naturally present. This is why multiple rounds are typically applied; the appropriate number of rounds will be determined on the basis of information obtained from the bench-scale test. See also Response A-4.

Response B-5

This ROD indicates that DOE will be responsible for ensuring that groundwater is not used for drinking while contaminants remain at levels that are considered unacceptable for unlimited use. DOE will implement groundwater use restrictions that are determined to be implementable and effective.

Response B-6

The data that the MDOH has obtained from its monitoring program covering private wells at off-site locations have been incorporated into the evaluation. This evaluation indicates that these private wells have not been impacted by site-related contamination.

Response B-7

DOE's proposed action for the chemical plant area GWOU provides for long-term monitoring of an optimized network of monitoring wells and springs that covers the August A. Busch Memorial Conservation Area.

Response B-8

DOE's commitment to provide long-term monitoring of the chemical plant area groundwater and springs will be implemented as stipulated in this ROD. The primary performance criteria that will be used in the five-year reviews will be protective of human health and the environment based on a combination of factors, including contaminant concentrations and groundwater use restrictions.

STATE OF MISSOURI
Mel Carnahan, Governor • Stephen M. Mahfood, Director
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176 Jefferson City, MO 65102-0176

August 31, 1999

CERTIFIED MAIL #P 179 979 879
RETURN RECEIPT REQUESTED

Mr. Steve McCracken, Project Manager
United States Department of Energy
Weldon Spring Remedial Action Project
7295 Highway 94 South
Weldon Spring, MO 63304

RE: PROPOSED PLAN FOR REMEDIAL ACTION FOR THE GROUNDWATER OPERABLE UNIT AT THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE (July 1999)

Dear Mr. McCracken:

The Missouri Department of Natural Resources (MDNR) has reviewed the above referenced plan received August 4, 1999. Initial comments for the draft Proposed Plan were transmitted to the Department of Energy (DOE) on June 25, 1999. Since then, we met with the DOE to discuss technical details and to resolve an informal dispute of issues related to the Groundwater Operable Unit (GWOU). After these meetings and final review of this plan, MDNR would like to reiterate and make some additional comments to those transmitted earlier and left unresolved. While we are raising these issues through the dispute resolution process, we are also providing our comments with this letter to insure that responses are included in the response to comments portion of the Record of Decision.

In general, we agree with the site characterization and contaminant profiles. We also support, as an initial means of treatment, the preferred alternative to treat a portion of the groundwater contamination through a chemical oxidation process, but need additional descriptions of performance and contingency plans. However, at this time, we cannot concur with the proposed action outlined in this plan due to the following unresolved issues:

C-1

1. The DOE has failed to adequately develop and assess groundwater treatment alternatives, including the pump and treat alternative in the Feasibility Study (FS) or Supplemental Feasibility Study (SFS). A more complete development of the alternatives to clean up contaminated groundwater at the site must be accomplished before a complete and accurate comparison can be made and a preferred remedy selected. DOE has been asked to fully develop the pump and treat alternatives by optimizing the pump and treat network through comments submitted on the SFS. A fair comparison of alternatives against the nine Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) evaluation criteria as stated in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) can not be performed. Additionally, due to the incompleteness of

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Response C-1

The evaluations presented in the FS (DOE and DA 1998) are consistent with the requirements of CERCLA. A thorough identification of applicable technologies was performed to support the development of alternatives. The proposed action was indicated as the best option on the basis of the comparative analysis performed using the evaluation criteria provided in the National Oil and Hazardous Substances Pollution Contingency Plan (EPA 1990). The pump and treat alternative option was evaluated as best as was possible; optimization of the pump and treat system design presented in the FS (DOE and DA 1998) and Supplemental FS (DOE 1999b) was deemed not useful since the results would not be applicable at the chemical plant area, where a karstic environment is present. The pump and treat design presented in the FS and Supplemental FS was, by necessity, that for an ideal homogeneous porous medium. See also Response A-1.

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C-1 Cont. alternative development, the preferred remedial action can not be selected with confidence, nor can the public compare the alternatives appropriately.

C-2

2. DOE inappropriately proposes to waive the Applicable or Relevant and Appropriate Requirements (ARARs) for water quality contaminants [nitrate and 2,4-Dinitrotoulene (2,4-DNT)] for the entire site based on Technical Impracticability (TI). DOE has not demonstrated TI as required by DOE and EPA policy. In addition, the proposed waiver does not provide a remediation goal if the waiver is granted. MDNR does not consider it technically impracticable to remediate nitrate or 2,4-DNT in certain contaminant zones at this site. Based on information provided by DOE, some contaminant zones can be remediated to meet ARARs in a reasonable specified time. DOE has yet to prepare a written TI evaluation. A written TI evaluation is one of the "major administrative responsibilities" specified in DOE policy regarding technical impracticability decisions. This evaluation must be submitted to the EPA TI review team in accordance with EPA Headquarters and Region VII policy before TI can be determined.

C-3

3. The DOE preferred alternative in the Proposed Plan is a limited effort to remediate Trichloroethylene (TCE) contamination in the groundwater via a chemical oxidation process. If unsuccessful, DOE claims they will have demonstrated Technical Impracticability for TCE, and that Monitored Natural Attenuation is the preferred alternative. DOE proposes a minimum of two rounds of chemical injection to remediate the TCE. MDNR supports the DOE agreement to meet the ARAR of 5 parts per billion (ppb) for TCE contamination across the entire site. Chemical oxidation is considered a cost effective alternative for the treatment of TCE at this site. However, implementation of the chemical oxidation process is a concern. Therefore, performance goals for the chemical oxidation process must be defined in the Proposed Plan. As related to the inappropriateness of TI, the pump and treat alternative would be a feasible contingency remedial action, in case the chemical oxidation process is unable to meet the 5-ppb ARAR for TCE.

C-4

4. The DOE has failed to include the groundwater standard for uranium at 40 CFR 192.02 as an ARAR. The Uranium Mill Tailings Radiation Control Act (UMTRCA) standard 40 CFR 192.02 for uranium in usable groundwater is 30 pCi/l and this standard is considered an ARAR for the groundwater at the chemical plant site. Recognition of the UMTRCA standard for uranium is required. The DOE and EPA agreed in the Record of Decision for the Quarry Residual Operable Unit (p. 40) that "40 CFR 192.02 would likely be an ARAR for any remedial action considered for the useable groundwater source south of the [Femme Osage] slough," and the DOE states in the Proposed Plan, "the groundwater at the chemical plant area is considered potentially useable." Therefore, the 40 CFR 192.02 groundwater standard for uranium is an ARAR for the GWOU.

C-5

5. DOE has referenced institutional controls in the Proposed Plan; however, no explanation as to the types, locations, or means to insure they remain effective for the necessary time frames is provided. The Proposed Plan must include: the purpose for the institutional controls, types of control, associated costs, long-term monitoring of compliance, a demonstration of the effectiveness of implementability, mechanisms of enforcement, and the mechanism for funding long-term oversight and necessary future remedial actions. These components are sometimes known as stewardship issues. Please refer to MDNR's comment letter dated June 21, 1999, on the Stewardship Plan, Revision A.

Response C-2

Waivers on the basis of TI were proposed for ARARs for nitrate, 2,4-DNT, and uranium for all the zones of groundwater contamination at the chemical plant area. This proposal was based on the inability of any of the alternatives evaluated to achieve these ARARs within a reasonable time frame.

While it is suggested in EPA Region VII guidance for determining TI that a TI evaluation report be prepared to support such a case, this is not a requirement. Further, the information already presented in the RI/FS documents (DOE and DA 1997a,b, 1998; DOE 1999a,b) establishes TI. Thus, no TI evaluation report is necessary. Incorporation of the components of a TI evaluation into the RI/FS documents to demonstrate TI is consistent with Region VII guidance and the region's past practices.

Response C-3

With respect to performance goals for the in-place chemical oxidation remedial action, see Responses A-4 and B-4. With respect to TI, see Response C-2.

Response C-4

Upon further consideration of the issue regarding identification of the groundwater standard for uranium identified in Title 40, Part 192, of the *Code of Federal Regulations* (40 CFR Part 192) as an ARAR, DOE has determined that this standard is not applicable, but is relevant and appropriate, and, therefore, is an ARAR for this remedial action.

Response C-5

DOE is committed to implementing groundwater use (drinking) restrictions at the chemical plant area and has proposed such as part of the proposed action. Specifics will be determined during the remedial design and remedial action phase. These specifications will include those vehicles of restrictions that are determined to be effective and implementable by DOE, the EPA, the state, and landowners (i.e., the Missouri Department of Conservation and the U.S. Department of the Army).

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C-6 6. DOE has failed to provide sufficient detail on how the Groundwater Operable Unit remediation and monitoring in the Proposed Plan will interface with monitoring and maintenance of the onsite disposal cell in order to remain protective. There is no discussion in the FS, SFS, or PP that provides details, comparisons, and assurances for any of the alternatives that will interface with the groundwater monitoring and action leakage rate plan for the disposal cell. DOE's present submittal regarding the action leakage rates for the waste cell is not in accordance with design values that the State has applied at other similar sites; contains inadequate factors of safety; lacks detail on leachate sump design and monitoring; and does not include the post-closure monitoring plan and action response plan.

C-7 Additionally, we have concerns regarding the public notice for comments to the Proposed Plan. Informal discussion held with DOE had provided the suggestion that property owners within the vicinity of the site using private water wells for drinking water be sent an invitation to the public meeting. Further, public meetings in the past utilized a post-card notice and invitation to stakeholders in addition to the guidance and legal requirements of placing notices in local newspapers and having the document available at the local information repositories. We question whether the provisions of the Community Relations Plan, section 5.6 Community Contact, have been met. Please provide a response to this issue by including a description of the types of public meeting notification used and a list of individual citizens that received the notification.

MDNR believes that these comments must be considered and that the proper changes must be made to the Proposed Plan document and also reflected in the future Record of Decision. Additional comments with further explanation are enclosed for your consideration. If you have questions about our concerns and comments, please feel free to contact Branden B. Doster of my staff at (573) 526-2739.

Sincerely,

HAZARDOUS WASTE PROGRAM

Larry V. Erickson

Larry V. Erickson, P.E., DOE Unit Chief
Federal Facilities Section

Enclosure

LVE:lbe

c: Dan Wall, EPA Region VII
Weldon Spring Citizens Commission
Kay Drey

Response C-6

The monitoring plans that will be needed for the various operable units at the Weldon Spring site will be incorporated into one final plan before project completion and site closure. This will allow for minimization of overlap, facilitate interpretation of data to determine any potential impacts, and allow for interface of the monitoring activities, as appropriate. The present submittal for the waste cell that is in question in the comment was prepared in consultation with the EPA and the state and meets CERCLA and RCRA requirements. However, further refinement of the action leakage rates will be presented in the final combined plan as previously mentioned in this response.

Response C-7

The provisions of the Community Relations Plan have been met. The public notification process for the public comment/meeting of the GWOU *Proposed Plan* (DOE 1999a) is the same process carried out for other public meetings previously held at the site, such as that for the public comment/meeting for the Proposed Plan for the Quarry Residuals Operable Unit in 1998. The public notification process in place is consistent with CERCLA requirements. The public, including property owners within the vicinity of the site using private wells for drinking water, were notified of the public meeting via newspaper announcements that appeared in two local newspapers at five various dates before the public meeting.

Specific Comments
Proposed Plan for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site, Weldon Spring, Missouri (July 1999)

The DOE has failed to adequately develop and assess groundwater treatment alternatives, including the pump and treat alternative in the Feasibility Study (FS) or Supplemental Feasibility Study (SFS). A more complete development of the alternatives to cleanup contaminated groundwater at the site must be accomplished before a complete and accurate comparison can be made and a preferred remedy selected.

DOE originally developed the pump and treat alternatives (#4and #7) in the FS that included the possibility of reinjecting treated groundwater back into the aquifer. This option (reinjection) was not developed further due to the large number of injection wells required and the low hydraulic conductivity thought to exist throughout the site (page 3-12, Ref. 1). Since the release of this FS, DOE has performed a field test to collect hydrogeological data in the area of Contaminant Zone #1. This field test, a Pilot Pump Test was completed in August 1998.

C-8

The new data from the Pilot Pump Test was compiled in a completion report (Completion Report for the Pilot Pump Test) which concluded that the transmissivity of Zone #1 was much greater than expected and that sustainable extraction rate exceeded previous expectations. Transmissivity is defined as the rate a fluid is transmitted through a unit width of porous media while under the influence of a unit hydraulic gradient. In the area of MW-3028, the transmissivity of the aquifer was over 700 times more than previously measured prior to the Pilot Pumping Test (p. 51, Ref 2). Table 1 shows the measured transmissivity for the area of concern. In addition, sustained injection rates of 10 gpm or greater in Zone #1 have been observed during previous dye trace studies (page 25, Ref. 2). This suggests that artificial recharge of the aquifer is feasible.

Table 1

Range of Transmissivity in the Area of MW-3028 (gpd/ft)

Before Pilot Pump Test	After Pilot Pump Test
2.9-9.1	6400-7600

The SFS was then developed to augment the original FS and to include this new data and reevaluate the feasibility of the pump and treat and other alternatives. Since conditions were not as previously suspected the possibility of artificially recharging the aquifer to optimize a pump and treat alternative has now been renewed. DOE has been asked to fully develop the pump and treat alternatives by including artificial recharge as part of the alternative. The pump and treat alternatives have not been fully developed to this date. Since the pump and treat alternatives have not been fully developed, a fair comparison of alternatives against the nine Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) evaluation criteria as stated in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) can not be performed. Due to the incompleteness of alternative development, the preferred remedial action can not be selected with confidence nor can the public compare the alternatives appropriately.

C-8 Cont.

DOE argues that at least four "optimized" extraction systems could be designed (Ref. 3). These four optimized systems could be designed to remediate contaminants in a specific time or to minimize cost, cleanup time, or cost and cleanup time. It would be appropriate for DOE to develop the pump and treat alternatives based on minimizing cost and cleanup time to use as a comparison against the other alternatives.

- DOE must fully develop all alternatives before selection of a preferred alternative. DOE must develop the pump and treat alternatives (#4 and #7) using an optimized network of extraction and possible injection wells so that a fair comparison of alternatives can be performed

DOE inappropriately proposes to waive the Applicable or Relevant and Appropriate Requirements (ARARs) for water quality contaminants [nitrate and 2,4-Dinitrotoulene (2,4-DNT)] for the entire site based on Technical Impracticability (TI). DOE has not demonstrated TI as required by DOE and EPA policy. In addition, the proposed waiver does not provide a remediation goal if the waiver is granted.

Waiver of ARARs for nitrate and 2,4-DNT for the entire site based on TI is inappropriate. MDNR does not consider it technically impracticable to remediate nitrate or 2,4-DNT in certain contaminant zones at this site. Based on information provided by DOE, some contaminant zones can be remediated to meet ARARs in a reasonable specified time. DOE has yet to prepare a written TI evaluation. A written TI evaluation is one of the "major administrative responsibilities" specified in DOE policy regarding technical impracticability decisions (Technical Impracticability Decisions for Ground Water at CERCLA Response Action and RCRA Corrective Action Sites, DOE/EH-413/9814, August 1998, citing Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration, Interim Final, OSWER Directive 9234.1-25, U.S. Environmental Protection Agency, September 1993.).

C-9

- The TI evaluation should be submitted to the EPA TI review team in accordance with EPA headquarters and Region VII policy (Consistent Implementation of the FY 1993 Guidance on Technical Impracticability of Ground-Water Restoration at Superfund

Sites, U.S. Environmental Protection Agency, OSWER Directive 9200.4-14, January 19, 1995).

DOE feels that it is technically impracticable to achieve reduction of contaminant levels to meet ARARs within a reasonable time frame due to several factors (p. 45-46, Ref. 4). These factors are listed below, along with evidence that suggests otherwise.

I) The hydrogeology present in the shallow groundwater system is highly complex and unfavorable for remediation using extraction methods.

This highly complex groundwater system includes fractures and weathered bedrock features (including paleochannels and dissolution features) that facilitate the extraction of groundwater. In areas that these features do not exist to a great extent, groundwater extraction is limited. These features only accelerate the ability to remove groundwater from the aquifer when compared to zones that do not have these features. The fracturing and dissolution features provide the needed pathways for the groundwater to flow down-gradient to an extraction well at a rate that will allow for remediation of contaminants in a reasonable time.

II) Sustainable yield is low (<10 gallons per minute, gpm).

C-9 Cont. The sustainable yield for Zone #1 likely exceeds 10 gpm (page 39, Ref. 2). This sustainable yield was limited by dewatering of the aquifer not the ability of the aquifer to transmit groundwater. This limiting factor (dewatering) can be neutralized by applying artificial recharge to the aquifer as groundwater is extracted. The Pilot Pumping Test concluded that sustainable yield greater than 10 gpm might be achievable if the aquifer was artificially recharged. Rates of 31 gpm were sustained for over one half a day without artificial recharge of the aquifer (page13, Ref. 2). With the addition of artificial recharge, higher extraction rates could be sustained (page 39, Ref. 2).

III) The area of influence of the extraction well is structurally controlled.

The area of influence is structurally controlled and this control generally corresponds to the boundaries of the contaminant Zone #1. An extraction well placed within a Zone of contamination and within these boundary conditions would influence the contaminant zone itself. The area of aquifer with the greatest concentration of contaminant would be influenced, since the contaminant resides within these controlling structures.

IV) The distribution of contaminant is complex and in general, of low concentration.

Concentrations 10-200 times the ARAR's of nitrate, TCE and 2,4-DNT are associated with contaminant Zone #1 (page 24, Ref. 4). The distribution of contaminants in Zones #1 and #2 seems to be bound by structural constraints and is localized, not complex or of low concentration.

Response C-8

See Responses A-1, A-2, and C-1.

Response C-9

As discussed in previous responses (A-1 and A-2), an optimized pump and treat system with artificial recharge cannot be designed for the contaminated zones identified at the chemical plant area. Ad hoc treatment could expedite the cleanup somewhat, but modeled cleanup times and efficiencies would not be scientifically defensible, and successful field implementation would be unlikely. For these conditions, the contaminated zones cannot be remediated to ARARs within a reasonable time frame. Because ARARs cannot be met within a reasonable time frame for nitrate, 2,4-DNT, and uranium, waivers based on TI have been proposed. For TCE, a waiver based on TI will be considered if the ARAR is not attained after implementation of an optimized remediation design of the in-situ chemical oxidation process. All of the documentation necessary for a TI waiver for the contaminants has been presented in the RI/FS documents (DOE and DA 1997a,b, 1998; DOE 1999a,b).

Response to item I) of Comment C-9: Although fractures and other karst features promote rapid transport of groundwater, they preclude defensible design and successful field implementation of pump and treat systems. Because fractures and karst features are frequently discontinuous (as indicated by the difference in sustainable pumping rates for the two wells in the pilot pump test [MK-Ferguson 1998]), locating extraction and reinjection wells in areas of contamination is unreliable and requires a trial-and-error approach that at best would leave residual levels of contamination that exceed ARARs. Rather than providing pathways for rapid cleanup, the fractures and other karst features produce complex hydrogeologies that are difficult to remediate within a reasonable amount of time.

Response to item II) of Comment C-9: see Response A-2.

Response to item III) of Comment C-9: Interpretation of the pilot pump test (MK-Ferguson 1998) indicated that drawdown was being affected by boundaries (i.e., drawdown did not follow the classic response of a pumping well in an infinite, homogeneous porous medium). The pumping well was responding as if it were situated in a linear fractured bedrock zone bounded by lower permeability bedrock. This type of behavior would be expected if the pumping well were located in a paleochannel that had a higher permeability than the surrounding material. This system is not bounded. Rather, it is unbounded along its longitudinal axis; its sidewalls, although lower in permeability, would still transport water and dissolved contaminants. An extraction well placed within the paleochannel could remove some undefinable quantity of contamination. However, as shown by the pilot pump test, an extraction well might also not remove any significant quantities of

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V) Cleanup times estimated by using very optimistic extraction rates are still excessively long.

These calculations are excessively long due to a few factors, including:

A) The minimal number of wells needed to contain the zone of contamination was used to calculate remediation times. This would equated to a conservatively long remediation time. The optimal number of wells to remediate a zone of contamination would provide for remediation of certain zones in a reasonable time period and a period of time that can be planned for.

B) Dewatering of the aquifer controls the sustainable pumping rate that was used to calculate remediation times. Dewatering can be eliminated by artificially recharging the aquifer, resulting in higher sustainable yields. An extraction/recharge network can be designed that will not dewater the aquifer and provide for reduction of contaminant levels to ARARs in a reasonable time period.

VI) Pumping tests performed at the site demonstrated that cleanup times would be excessive because of low yields, long recovery times for groundwater levels and high
C-9 potential for dewatering the adjacent porous media.

Cont.

A) The Pilot Pumping Test concluded that a sustainable yield greater than 10 gpm might be achievable if the aquifer was artificially recharged (page 39, Ref. 2). Sustainable yields of this caliber will support an extraction type remedial alternative and attain ARARs in a reasonable time or one that can be planned for.

B) Long recovery times and dewatering can be controlled by a properly designed extraction/recharge system.

In addition, since Dardenne Creek is a no discharge drainage, the need to treat groundwater that discharges at springs and seeps into this drainage is evident. Groundwater contaminated with wastes originating from WSSRAP (uranium, nitrate, etc.) surface at seeps and springs such as Burgermeister Spring. This wastewater can not be allowed to drain in the Dardenne Creek drainage system. Treatment of water discharging at these locations must be performed to protect this drainage.

- The PP and preferred alternative should include treatment of these waters.

The DOE preferred alternative in the Proposed Plan is a limited effort to remediate
C-10 Trichloroethylene (TCE) contamination in the groundwater via a chemical oxidation process. If unsuccessful, DOE claims they will have demonstrated Technical Impracticability for TCE, and that Monitored Natural Attenuation is the preferred

alternative. DOE proposes a minimum of two rounds of chemical injection to remediate the TCE.

MDNR supports the DOE agreement to meet the ARAR of 5 ppb for TCE contamination across the entire site. Chemical oxidation is considered a cost effective alternative for the treatment of TCE at this site. However, implementation of the chemical oxidation

C-10 process is a concern.

- Therefore, performance goals for the chemical oxidation process must be defined in the Proposed Plan.
- As related to the inappropriateness of TI, the pump and treat alternative would be a feasible contingency remedial action, in case the chemical oxidation process is unable to meet the 5-ppb ARAR for TCE.

The DOE has failed to include the groundwater standard for uranium at 40 CFR 192.02 as an ARAR. The Uranium Mill Tailings Radiation Control Act (UMTRCA) standard 40 CFR 192.02 for uranium in usable groundwater is 30 pCi/l and this standard is considered an ARAR for the groundwater at the chemical plant site.

- Recognition of the UMTRCA standard for uranium is required.

C-11

The DOE and EPA agreed in the *Record of Decision* for the Quarry Residual Operable Unit (p. 40) that "40 CFR 192.02 would likely be an ARAR for any remedial action considered for the useable groundwater source south of the [Femme Osage] slough," and the DOE states in the *Proposed Plan*, "the groundwater at the chemical plant area is considered potentially useable." Therefore, the 40 CFR 192.02 groundwater standard for uranium is an ARAR for the GWOU.

Institutional controls are proposed with no explanation of the cost to implement or enforce. The burden for monitoring and enforcing appears to be delegated to authorities other than DOE. There are no support provisions for those authorities to carry out the responsibilities. Similarly, there is no information regarding how DOE will compel the affected property owners to accept the land use restrictions. There is no definition of the mechanisms that will be used to put institutional controls in place.

The Proposed Plan must include these components

C-12

- purpose for the institutional controls
- types of control
- associated costs
- long-term monitoring of compliance
- demonstration of effectiveness to implement
- mechanisms of enforcement
- provide funding for long-term oversight and necessary future remedial actions

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C-12 Cont. This approach is out lined in section IV of *Institutional Controls: A Reference Manual, WORKGROUP DRAFT* that was prepared by the U.S. EPA Workgroup on Institutional Controls and published March, 1998. This document states that "the standard of care and degree of analysis in the FS should be as high for ICs as for other elements of the remedy." These component are sometimes know as stewardship issues. Please refer to MDNR's comment letter dated June 21, 1999 on the Stewardship Plan, Revision A.

REFERENCES

1. U.S. Department of Energy and U.S. Department of the Army, 1998, *Feasibility Study for the Groundwater Operable Units at the Chemical Plant Area and the Ordnance Works Area at the Weldon Spring Site, Weldon Spring, Missouri*, DOE/OR/21548-569, prepared by Argonne National Laboratory, Argonne, IL, for U.S. Department of Army, Corps of Engineers, Kansas City District, Kansas City, MO, Dec.

2. MK-Ferguson Company and Jacobs Engineering Group, Inc., 1998, *Completion Report for the Pilot Pumping Test for the Groundwater Operable Unit at the Weldon Spring Site*, DOE/OR/21548-757, prepared for U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project, St. Charles, MO, Oct.

3. Responses to MDNR's Comments, on *Draft Supplemental Feasibility Study for the Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site, Weldon Spring, Missouri*, March 1998

4. U.S. Department of Energy, 1999, *Proposed Plan for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site, Weldon Spring, Missouri*, DOE/OR/21548-733, prepared by Argonne National Laboratory, Argonne, IL, for U.S. Department of Energy, Weldon Spring Site Remedial Action Project, Weldon Spring, MO, July.

Response C-9 Cont.

water if the well does not intercept the fracture system. System performance in such a system would, therefore, depend on a trial-and-error approach, and substantial quantities of contamination could remain in the system for a long time.

Response to item IV) of Comment C-9: Although the contaminant concentrations range from 10 to 200 times the ARARs, the distributions are characterized by discrete locations containing higher concentrations with much lower concentrations in adjacent locations (for some of the zones of contamination, a contaminant concentration exceeded the ARAR in only one well). Because the spatial extent of contamination lies within a region of fractures and karst features, the underlying hydrogeology and transport mechanisms are complex. Where the contamination exists in fractures, fractures control its transport. In other areas, transport is controlled by advection, dispersion, diffusion, sorption, and degradation.

Response to item V) of Comment C-9: see Responses A-1 and A-2.

Response to item VI) of Comment C-9: see Responses A-1 and A-2. Treatment of springwater is not needed because the requirement of no discharge to Dardenne Creek is applicable to wastewater and not springwater. Further, treatment of springwater (e.g., that at Burgermeister Spring) is not needed because the uranium levels in this water are well below the DOE's derived concentration guide (DCG) of 600 pCi/L for uranium.

Response C-10

See Responses A-4 and C-3.

Response C-11

See Response C-4.

Response C-12

See Response C-5.

515 West Point Ave.
University City, MO 63130
September 1, 1999

Mr. Stephen H. McCracken, Project Manager
Weldon Spring Site Remedial Action Project Office
U.S. Department of Energy
7295 Highway 94 South
St. Charles MO 63304

Fax: 314-447-0739
Attn: Karen Reed

Dear Mr. McCracken:

Probably it was about ten years ago when a geologist responded to some of my concerns about the Weldon Spring contamination by saying: "The one thing you really have to worry about is that the Department of Energy (DOE) not be allowed to walk away from the site without cleaning up the groundwater to concentrations consistent with natural background." At the time I considered such a possibility to be preposterous.

D-1 And yet, having read the "Proposed Plan for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site," July 1999, DOE/OR/21548-733, and many other documents about groundwater over the past 25 years, I am afraid that the DOE is proposing to do just that: to try to remove the chlorinated solvent/degreasing compound, trichloroethylene (TCE), from the raffinate pit area, and leave the rest of the groundwater contaminants to migrate wherever. (The page citations below will refer to the "Proposed Plan" unless otherwise noted.)

I do not criticize the decision to try to break down TCE, a known carcinogen, or the DOE's choice of a particular process. I am questioning, however, the decision to ignore other significant toxins in the groundwater, and particularly the long-lived radioactive contaminants of concern. Unlike TCE, uranium and thorium and radium -- also known carcinogens -- will not break down, volatilize, microbially degrade or otherwise "naturally attenuate." They will continue giving off radioactive particles and rays for literally hundreds of thousands or even billions of years into the future -- that is, they will remain hazardous virtually forever. The proposal to leave these poisons in the St. Charles groundwater, upstream from St. Louis, is surprising and, I believe, irresponsible.

D-2 I am writing this letter to submit questions and comments about the proposed plan, but also to request additional time for the public to respond, preferably at a public hearing in St. Louis, the major nearby community downstream that is dependent upon the Missouri River for drinking water. I was out of town on vacation the first three weeks in August when the packet of documents arrived announcing the August 25 meeting. Most people who are able to take summer vacations do so in June, July or August. Furthermore, I'm told the St. Louis Post-Dispatch did not publish information about the public meeting in advance (or afterwards).

D-3 1. The greatest surprise of the "Proposed Plan" is the conclusion that TCE has been designated "the predominant potential risk driver" at Weldon Spring and that its chemical oxidation "offers the greatest potential for short-term

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Response D-1

In addition to TCE, the other contaminants of concern in groundwater at the chemical plant area are nitrate, nitroaromatic compounds, and uranium. Laboratory analysis of groundwater samples taken from the monitoring wells has indicated that radium and thorium concentrations are similar to background or at nondetectable levels. Although radium and thorium have been identified as soil contaminants, these radionuclides are not as soluble as uranium. This is why uranium has been the only radionuclide detected in the groundwater at the chemical plant area.

The proposed action provides for in-place treatment of TCE and long-term monitoring of the other contaminants, including uranium. This is the best option based on the comparative analysis of alternatives performed. See also Responses A-1 and C-1.

Response D-2

The public comment/meeting was announced in two local newspaper (*St. Charles Journal and St. Charles Post*) advertisements at various dates before the public meeting date. A 30-day public comment period was held consistent with CERCLA requirements; in addition, the arrangements for the public meeting were similar to those for public meetings previously held for the site.

Response D-3

The contaminants of concern in groundwater at the chemical plant area were identified on the basis of all the data collected to date (including those collected before 1996). TCE concentrations in a few monitoring wells were estimated to result in potential carcinogenic risks slightly greater than the EPA's acceptable risk range for a hypothetical resident scenario. The other contaminants mentioned in the comment have not been identified as contaminants of concern.

reduction" of risk. (p. 43) How and when was the decision made that "TCE treatment" was to be the critical goal of the groundwater cleanup (e.g., Table 4)? The contamination by TCE and other volatile organic compounds was not even detected until 1996. ("Weldon Spring Site Environmental Report, 1998,"
D-3 pp. 138-9) That was long after many scientists and engineers had acknowledged
Cont. the existence of groundwater contamination, and the unquestionable need to resolve it. With the DOE's preferred Alternative 9, "<u>some</u> treatment of nitroaromatic compounds in addition to TCE <u>might</u> also occur." (emphases added; page 39) But what about such Weldon Spring contaminants as arsenic, manganese, cadmium, selenium, <u>and radioactive uranium and thorium and</u> . . . ?

2. Available monitoring equipment apparently is not yet capable of detecting thorium in water, and not even always accurately in soil. (Unfortunately, neither the government nor corporations seem to have any interest in developing more precise measuring instruments.) While it is known that not
D-4 just uranium and thorium were discharged out the stacks at the Weldon Spring chemical plant -- and therefore the related daughter products, such as, radium, polonium, radon and lead-210 -- [redacted] measurement of the range and depth of the resulting contamination of the soil did not extend throughout the 200-acre tract. How much of the soil contaminants will continue leaching into the groundwater?

3. At Fernald, Ohio, where the same type of uranium processing facility operated, vertical extraction wells have been installed as a part of the Aquifer Restoration Project in order to pump contaminated groundwater for treatment before releasing it to the Great Miami River. Why is the DOE's Fernald project receiving funds for thorough groundwater remediation, and not
D-5 Weldon Spring? -- The Fernald modeling data estimated that the uranium levels in the aquifer would reach the proposed drinking water standard within 27 years at the expected pumping rate. Having already spent $900 million and several decades on the Weldon Spring cleanup, would additional funding and an extended duration not be warranted? Why are citizens in St. Charles County not asking that question -- and others?

4. Two or three of the highest uranium levels in groundwater in 1998 were collected along the KATY trail (next to the south wall of the quarry -- namely, monitoring wells 1006, 1008 and 1032 -- according to the "Weldon Spring Environmental Report, 1998," pp. 148, 151). The predominant uranium isotope (U-238) has a half-life of 4.5 billion years; thorium-232, also
D-6 present at Weldon Spring, has a half-life of 14.1 billion years. Adherence to Superfund requirements dictates that a review must be conducted every five years at locations where the groundwater contaminant levels exceed permissible standards for unlimited use by the public. Every five years -- for how many millennia?

5. Because of the "complex hydrogeology and heterogeneous geology of the site," including greater transmissivity than expected, "a pump and treat technology is not technically practicable" for cleaning up the groundwater, nor is sophisticated groundwater modeling possible. (p. 44) This complex
D-7 geology -- predominantly karst! -- and the "innovative nature of the technology" make even the chosen TCE treatment highly uncertain. Waivers of the TCE standard may be required and of the nitrate and nitroaromatic requirements, as well. Are these concerns not reminiscent of some of the many reasons the State of Missouri had formerly forbidden the siting of hazardous

Response D-4

The groundwater monitoring effort conducted for the site has been extensive and thorough, as indicated by the number of wells and the amount of data collected to date (over a decade of sampling). It is not likely that other radionuclides will leach into the groundwater that are not already in the groundwater. To date, uranium has been the only radionuclide reported at low but greater than background levels. In addition, source removals that are about to be completed should minimize, if not halt, any potential leaching into the groundwater. See also Response D-1.

Response D-5

The hydrogeology at the Fernald site is considered to be more of a homogeneous porous medium as compared with the heterogeneous karstic environment that is present at the chemical plant area of the Weldon Spring site. The difference in hydrogeology made the pump and treat option more feasible at Fernald than at the Weldon Spring site.

Response D-6

Five-year reviews will be conducted to evaluate the selected remedies at the Weldon Spring site, including that for the Quarry Residuals Operable Unit. The conclusions reached at these reviews will determine the need for any subsequent additional five-year reviews. Overall protection of human health and the environment will be the primary consideration in these reviews. See also Response B-8.

Response D-7

The geology of the location of the disposal cell at the chemical plant area has been thoroughly investigated and has been determined to be suitable for such a facility, as discussed in the RI/FS-environmental impact statement (DOE 1992a–e) prepared for the chemical plant. The results of the investigations have been reviewed by the State of Missouri and EPA Region VII, and all parties have agreed that the disposal cell area of the Weldon Spring site is acceptable for construction of the disposal facility to contain the waste resulting from site cleanup. In addition, the disposal cell design meets all state siting requirements, as discussed in the chemical plant ROD (DOE 1993).

waste facilities within a karst terrain?

D-8 6. "The proposed Maximum Concentration Level of 20 micrograms per liter for uranium is regarded as a to-be-considered requirement (TBC) for this action." (p.44) What does that mean? What standard, if any, would rule?

D-9 7. According to ~~Title 40 of~~ the Code of Federal Regulations," Title 40, Sections 265.90-94, a groundwater monitoring program must be continued throughout the life of a hazardous waste disposal facility licensed under the Resource Conservation and Recovery Act of 1976, as amended (RCRA). The design life of a facility outlines how long it will function adequately. Maybe a hazardous waste disposal cell won't leak for ten years, but as you get closer to the design life, greater leakage should be anticipated. If DOE is not committed to removing the predominant contaminants of concern from the groundwater even before the disposal cell is completed, is it not probable the groundwater will never meet RCRA standards?

D-10 8. How can either the Southeast Drainage Ditch (originally, an outfall sewer for the uranium plant process wastes) or the Burgermeister Spring be called any "end point"? (p. 8)

Some comments:

D-11 1. Although domestic wells are not currently located within the site, drinking water is obtained both from the Missouri and Mississippi rivers into which the groundwater flows. Also, the groundwater and springs impact upon lakes used for fishing, and perhaps upon such streams as the Dardenne. Unfortunately, a great deal is unknown about the directions and flow rates of groundwater, and particularly at a site underlain by a karst aquifer. And within time frames of thousands of years and beyond.

D-12 2. An estimated 3500 curies of thorium alone will be piled into the disposal cell at Weldon Spring. I urge anyone making decisions about the future of the cell -- with its 2.5 million tons/five billion pounds of radioactive and hazardous wastes -- to reflect on the magnitude of the danger. Perhaps the best comparison is with the amount of radioactivity used by the physicians, scientists and technicians who work with radioisotopes at the Washington University Medical Center: 1,069 laboratories use a total of TWO curies at any one time.

D-13 3. As a St. Louis resident who gets her drinking water from the Missouri River only nine miles downstream from the major Weldon Spring groundwater and surface water discharge pathways, and as a taxpayer who helped pay for the billion-dollar Weldon Spring remediation project, I find three of the DOE's reasons for not being able to clean up the groundwater both interesting and disheartening:

<> The hydrogeology present in the shallow groundwater system is highly complex and unfavorable (i.e., karst features such as paleochannels, conduits, fractures, weathering, and dissolution features) for remediation using extraction methods;

<> In spite of source removal at the ground surface, residual contaminants are likely to be present in undefinable and irremovable

Response D-8

The EPA defines to-be-considered (TBC) requirements as those advisories, criteria, or guidance developed by the EPA, other federal agencies, or states that might be useful in developing a remedy for a National Priorities List site. These TBCs are standards or guidelines that have not been properly promulgated but may be pertinent to the action being considered. TBCs are typically considered only if no promulgated requirements exist that are ARARs. For this ROD, the 40 CFR Part 192 standard for uranium of 30 pCi/L is considered an ARAR and is the remediation goal in the selected remedy presented in this ROD. See Response C-4.

Response D-9

A groundwater monitoring program in accordance with 40 CFR 264, Subpart F, has been established at the Weldon Spring site. This program has been implemented to determine the impacts of the disposal cell on the quality of the groundwater underlying this facility.

Response D-10

The Southeast Drainage and Burgermeister Spring are considered to be end points for direct groundwater transport from the chemical plant area because groundwater discharges to the surface at these locations.

Response D-11

Groundwater flow in the chemical plant area has been investigated and understood. End points of direct groundwater flow and transport are evident at Burgermeister Spring and springs in the Southeast Drainage. Contaminants discharged in these springs are well below levels outlined in DOE Orders.

Response D-12

DOE recognizes the hazards associated with the radioactive materials placed in the on-site disposal cell, which has been designed to safely contain these materials from the environment. Extensive quality control procedures were used during cell construction and waste placement activities to ensure that the cell will perform as planned. The cell design includes provisions to maximize surface water runoff, and a clay cover has been used to limit water infiltration into the wastes. The thick cover of earthen materials on top of the cell provides shielding from the gamma radiation emitted as the radionuclides decay, and a leachate collection system has been installed to collect any leachate that may be generated. The Weldon Spring disposal cell incorporates extensive containment requirements commensurate with the hazards posed by the radioactive materials generated by the cleanup activities. This cell will safely confine these materials from the environment.

quantities in the karst features beneath the chemical plant area; and

D-13 Cont. <> Cleanup times estimated by using very optimistic extraction rates are still excessively long (i.e., hundreds to thousands of years depending on the contaminant of concern). (p. 45)

D-14 I believe the Environmental Protection Agency should question the DOE's claim that it will be remediating the Weldon Spring groundwater and springs when it will only be focusing on one volatile solvent in one limited area of the site and will be ignoring the predominant, long-lived contaminants of concern -- that is, uranium, thorium and their radioactive daughter products. If the groundwater and springs are not cleaned up, the public should be appropriately warned.

Weldon Spring is certainly safer than it was twenty or thirty years ago, and the DOE deserves [redacted] credit. But I question whether Weldon Spring is safe enough yet to become a park -- or even a neighbor.

Sincerely,

Kay Drey

Kay Drey

Response D-13

(A.) Karst groundwater systems are typically unfavorable for groundwater extraction because of the limited extent of the more transmissive fracture zones and conduits. This constraint results in dewatering and limited recharge to the aquifer as groundwater is withdrawn. See Responses A-2 and C-2.

(B.) It is understood that residual contamination is present in the fracture zones and conduits in the vicinity of the chemical plant (5300 and 6300 Drainages.) Impact to the springs is a result of mobilization of these residuals by surface water and does not reflect the groundwater quality beneath the chemical plant.

(C.) Because of the heterogeneous and complex nature of the aquifer beneath the chemical plant, extraction rates are low, thereby resulting in excessively long remediation time frames.

Response D-14

In addition to the TCE remediation, the proposed action provides for monitoring of the uranium in groundwater. There are no other radionuclides of concern. The ROD provides for long-term controls that will ensure that the public is informed of site conditions.

St. Charles County Government

Department of Community Health
and the Environment
Gil Copley, Director
Division of Environmental Services
Mike Duvall, Deputy Director

September 1, 1999

Stephen H. McCracken, Project Manager
U.S. Department of Energy,
Weldon Spring Site Remedial Action
7295 Highway 94 South
St. Charles, Missouri 63304

Dear Steve,

E-1 In response to the Public Comment Period on the groundwater operable unit, we feel that an active program of remediation of the groundwater should be used together with monitored natural attenuation. The alternate selected does not fully address all of the contaminants in the groundwater. We would ask that DOE make every effort possible to clean up these contaminants to as low a level as technically possible.

E-2 Although at this time, the TCE is not moving rapidly, there is a possibility that without active remediation, the TCE plume over the years will naturally seek a lower level and find another aquifer feeding different wells than currently anticipated. No aquifer is ever totally confined.

E-3 The stated level of permissible Uranium in the groundwater remains too high. Whatever the time or cost factors, existing levels of Nitrate and 2,4-DNT need to be cleaned up to a level that is technically feasible today. This groundwater resource should not remain contaminated until every possible means to clean it is exhausted. We feel these actions need more emphasis in the proposed plan.

E-4 With respect to a future stewardship plan, in the event the contaminated groundwater aquifer eventually seeks new areas beyond its present confines, we request that a long-term/contingency funding commitment be made to Missouri DNR with the County as a partner. This would be for remediation of this water if needed. We request that this matter be decided up-front rather than negotiation after the fact.

Thank you for the opportunity to comment on this plan.

Sincerely,

Mary A. Halliday

Mary A. Halliday
Environmental Program Educator

023689

SEP - 2 1999

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Response E-1

The proposed action combines active remediation of TCE with long-term monitoring for natural attenuation of all the contaminants. The proposed action addresses all the contaminants of concern; per other responses given in this responsiveness summary, the proposed action is the best option identified from the evaluations performed. See Responses A-2 and C-1. Every effort was made to identify applicable technologies to develop the alternatives.

Response E-2

The TCE has been found to be in the upper shallow portion of the contaminated aquifer. The concentration of TCE found is considerably lower than what you would consider as a sinker or a dense nonaqueous phase liquid; therefore, the possibility of the TCE sinking to lower portions of the aquifer is unlikely. Also, groundwater movement in the shallow aquifer is controlled principally by horizontal fractures, bedding planes, and solution features, which limit vertical movement of the groundwater.

Response E-3

Comment noted. See Responses C-1, C-4, and E-1.

Response E-4

Studies conducted to date indicate that the boundaries of the contamination are well understood. In addition, long-term monitoring will be performed by DOE to ensure that these zones of contamination are not expanding and are stable.

DOE acknowledges the concern regarding funding. However, this issue is outside the scope of this decision.

REFERENCES FOR APPENDIX A

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